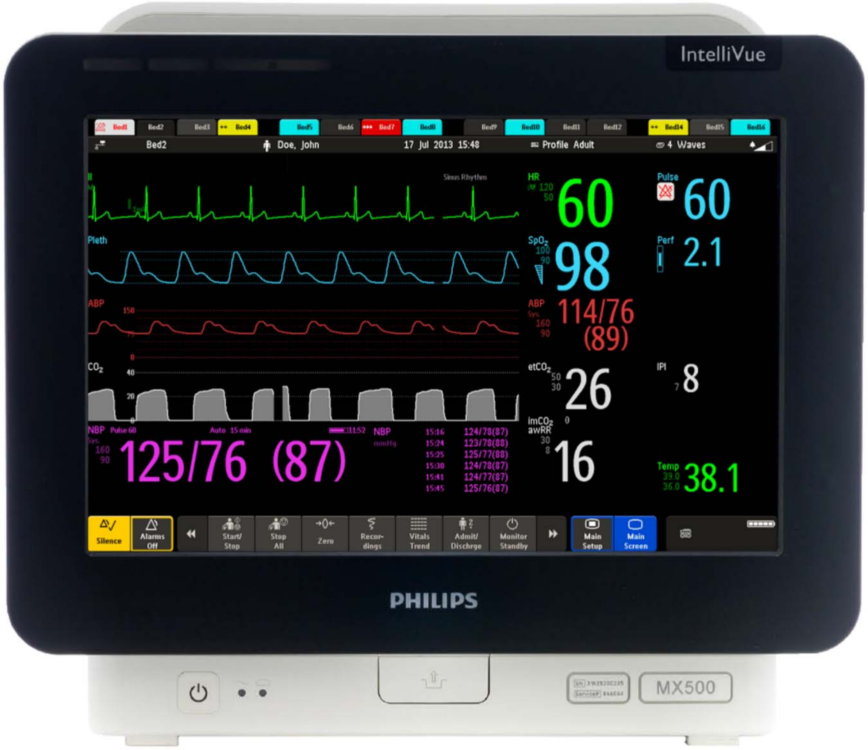
IntelliVue
PHILIPS
MX500

Service Guide

IntelliVue Patient Monitor

MX400/MX450/MX500/MX550

Release K.2x.xx

Patient Monitoring

PHILIPS

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1

Introduction

This Service Guide contains technical details for the IntelliVue MX400/450/500/550 Patient Monitor, the measurement modules, the Multi-Measurement Module (MMS), the IntelliVue X2, and the Measurement Server Extensions.

This guide provides a technical foundation to support installation, effective troubleshooting and repair. It is not a comprehensive, in-depth explanation of the product architecture or technical implementation. It offers enough information on the functions and operations of the monitoring systems so that engineers who install or repair them are better able to understand how they work.

It covers the physiological measurements that the products provide, the Measurement Server that acquires those measurements, and the monitoring system that displays them.

Who Should Use This Guide

This guide is for biomedical engineers or technicians responsible for installing, troubleshooting, repairing, and maintaining Philips' patient monitoring systems.

How to Use This Guide

Navigate through the table of contents at the left of the screen to select the desired topic. Links to other relevant sections are also provided within the individual topics. You can also scroll through the topics using the page up and page down keys.

Abbreviations

Abbreviations used throughout this guide are:

Name	Abbreviation
IntelliVue MX400/450/500/550 Patient Monitor	the monitor
Multi-Measurement Module	MMS
Measurement Link	MSL
Medical Information Bus	MIB
IntelliVue G1/G5 Gas Analyzers	G1/G5, the gas analyzer

Responsibility of the Manufacturer

Philips only considers itself responsible for any effects on safety, EMC, reliability and performance of the equipment if:

- assembly operations, extensions, re-adjustments, modifications or repairs are carried out by persons authorized by Philips, and
- the electrical installation of the relevant room complies with national standards, and
- the instrument is used in accordance with the instructions for use.

To ensure safety and EMC, use only those Philips parts and accessories specified for use with the monitor. If non-Philips parts are used, Philips is not liable for any damage that these parts may cause to the equipment.

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Hewlett-Packard Str. 2

71034 Böblingen, Germany

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Philips shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Passwords

In order to access different modes within the monitor a password may be required. The passwords are listed below.

CAUTION

Your hospital/organization is responsible that the passwords listed below are revealed to authorized personnel only.

Monitoring Mode: No password required

Configuration Mode: 71034

Demo Mode: 14432

Service Mode: 1345

Consult the configuration guide before making any changes to the monitor configuration.

Safety Information

Warnings and Cautions

In this guide:

- A **warning** alerts you to a potential serious outcome, adverse event or safety hazard. Failure to observe a warning may result in death or serious injury to the user or patient.
- A **caution** alerts you where special care is necessary for the safe and effective use of the product. Failure to observe a caution may result in minor or moderate personal injury or damage to the product or other property, and possibly in a remote risk of more serious injury.

Electrical Hazards and Interference

WARNING

Grounding: To avoid the risk of electric shock, the monitor must be grounded during operation. If a three-wire receptacle is not available, consult the hospital electrician. Never use a three-wire to two-wire adapter.

Electrical shock hazard: Do not open the monitor or measurement device. Contact with exposed electrical components may cause electrical shock. Refer servicing to qualified service personnel.

Leakage currents: If multiple instruments are connected to a patient, the sum of the leakage currents may exceed the limits given in IEC/EN 60601-1, IEC 60601-1-1, UL 60601-1. Consult your service personnel.

Radio frequency interference: The monitor generates, uses and radiates radio-frequency energy, and if it is not installed and used in accordance with its accompanying documentation, may cause interference to radio communications.

Use Environment

WARNING

Explosion Hazard: Do not use in the presence of flammable anesthetics or gases, such as a flammable anesthetic mixture with air, oxygen or nitrous oxide. Use of the devices in such an environment may present an explosion hazard.

Positioning Equipment: The monitor should not be used next to or stacked with other equipment. If you must stack the monitor, check that normal operation is possible in the necessary configuration before you start monitoring patients.

Environmental Specifications: The performance specifications for the monitors, measurements and accessories apply only for use within the temperature, humidity and altitude ranges specified in .

Liquid Ingress: If you spill liquid on the equipment, battery, or accessories, or they are accidentally immersed in liquid, contact your service personnel or Philips service engineer. Do not operate the equipment before it has been tested and approved for further use.

Prohibited Environments: The monitors are not intended for use in an MRI environment or in an oxygen-enriched environment (for example, hyperbaric chambers).

Alarms

WARNING

- Do not rely exclusively on the audible alarm system for patient monitoring. Adjustment of alarm volume to a low level or off during patient monitoring may result in patient danger. Remember that the most reliable method of patient monitoring combines close personal surveillance with correct operation of monitoring equipment.
- Be aware that the monitors in your care area may each have different alarm settings, to suit different patients. Always check that the alarm settings are appropriate for your patient before you start monitoring.

Accessories

WARNING

Philips' approval: Use only Philips-approved accessories. Using other accessories may compromise device functionality and system performance and cause a potential hazard.

Reuse: Never reuse disposable transducers, sensors, accessories and so forth that are intended for single use, or single patient use only. Reuse may compromise device functionality and system performance and cause a potential hazard.

Electromagnetic compatibility: Using accessories other than those specified may result in increased electromagnetic emission or decreased electromagnetic immunity of the monitoring equipment.

Damage: Do not use a damaged sensor or one with exposed electrical contacts.

Cables and tubing: Always position cables and tubing carefully to avoid entanglement or potential strangulation.

MR Imaging: During MR imaging, remove all transducers, sensors and cables from the patient. Induced currents could cause burns.

Maintenance, Repair and Care

WARNING

Maintenance and Repair:

- Do not maintain or repair the device in patient vicinity.
- Failure on the part of the responsible individual hospital or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Performance verification: do not place the system into operation after repair or maintenance has been performed, until all performance tests and safety tests listed in Testing and Maintenance of this service manual have been performed. Failure to perform all tests could result in erroneous parameter readings, or patient/operator injury.

Care and Disinfection:

- To avoid contaminating or infecting personnel, the environment or other equipment, make sure you disinfect and decontaminate the monitor appropriately before disposing of it in accordance with your country's laws for equipment containing electrical and electronic parts.
- For disposal of parts and accessories such as thermometers, where not otherwise specified, follow local regulations regarding disposal of hospital waste.

2

Theory of Operation

Integrated Monitor Theory of Operation

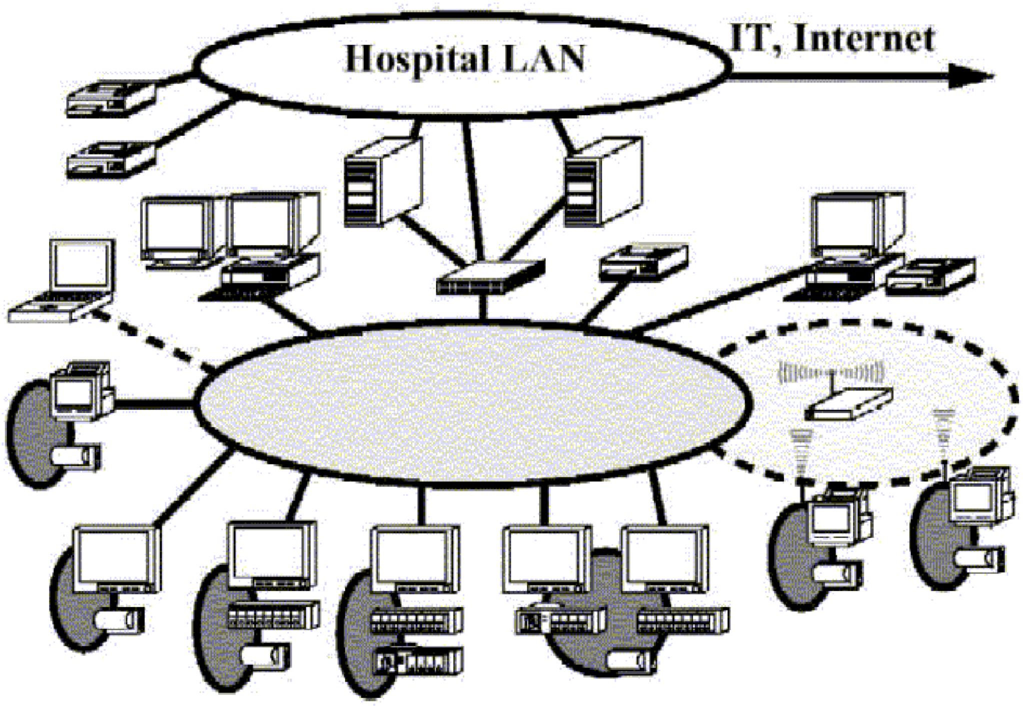
The IntelliVue MX400/450/500/550 Patient Monitor:

- displays real-time data
- controls the attached multi-measurement modules
- alarms in the case of patient or equipment problems
- offers limited data storage and retrieval (trending)
- interfaces to the Philips Clinical Network and other equipment

A monitor with just a single integrated measurement module can be connected to additional building blocks to form a monitoring system with a large number of measurements and additional interface capabilities and multiple slave displays. These elements cooperate as one single integrated real-time measurement system.

System Boundaries

The following diagram discusses specific boundaries within the overall system with respect to their openness and real-time requirements:



System Boundaries

⬬	Measurement connections Built-in measurement block
⬭	Philips Clinical Network (wired LAN) connects multiple patient monitors, information centers, application servers; closed system, only Philips qualified products (tested and with regulatory approval) are connected, Philips is responsible for guaranteed real-time functionality and performance
◌	Philips Clinical Network (wireless) like Philips Clinical Network (wired) LAN, however due to current wireless technologies available it has reduced bandwidth, longer latencies, reduced functionality
◯	Hospital LAN, Internet Standard Network, not under Philips control, no guaranteed service, no real-time requirements

Hardware Building Blocks

The following hardware building blocks make up the monitoring system:

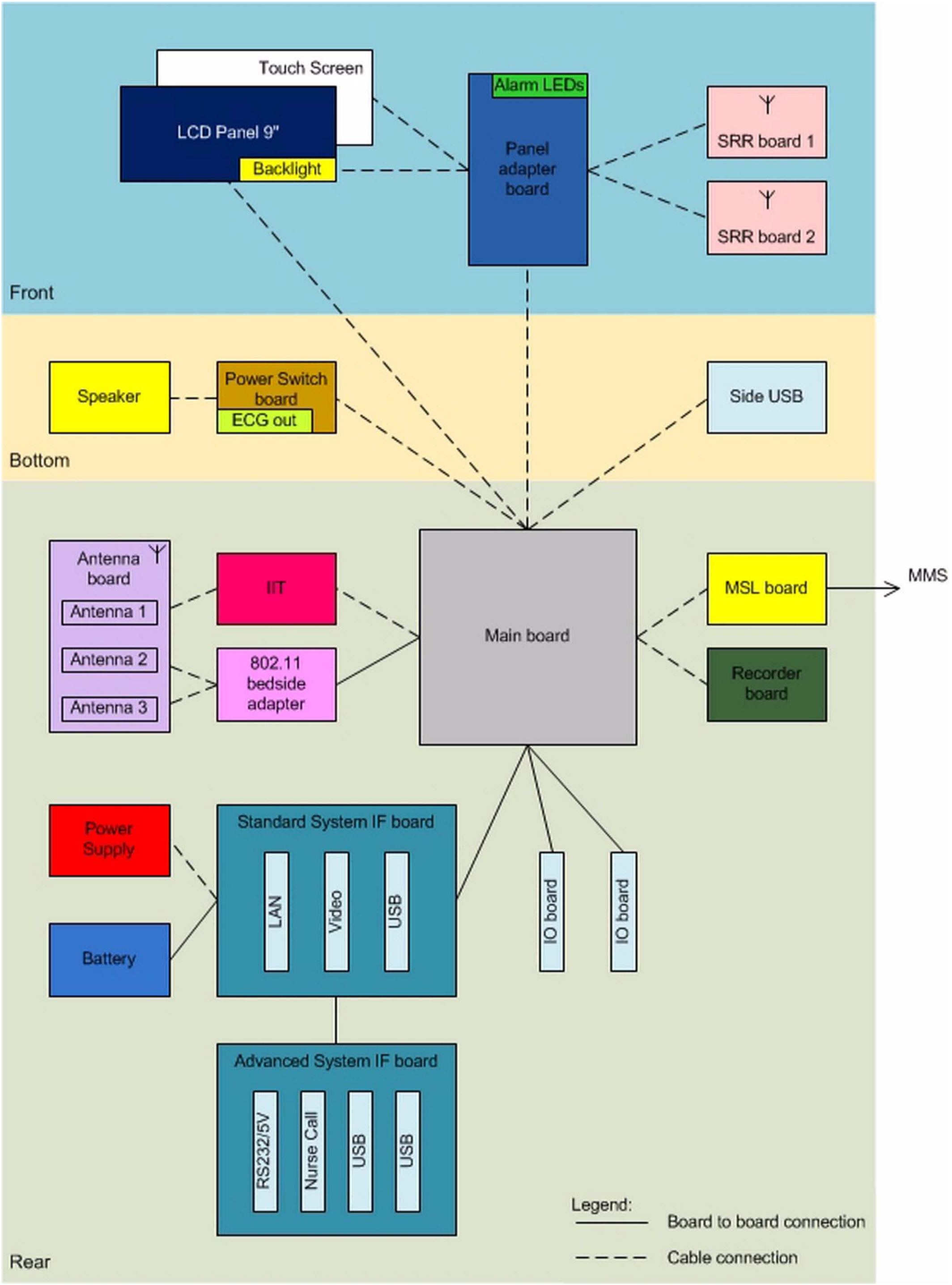
IntelliVue MX400/450/500/550

The IntelliVue MX400/450/500/550 Monitor:

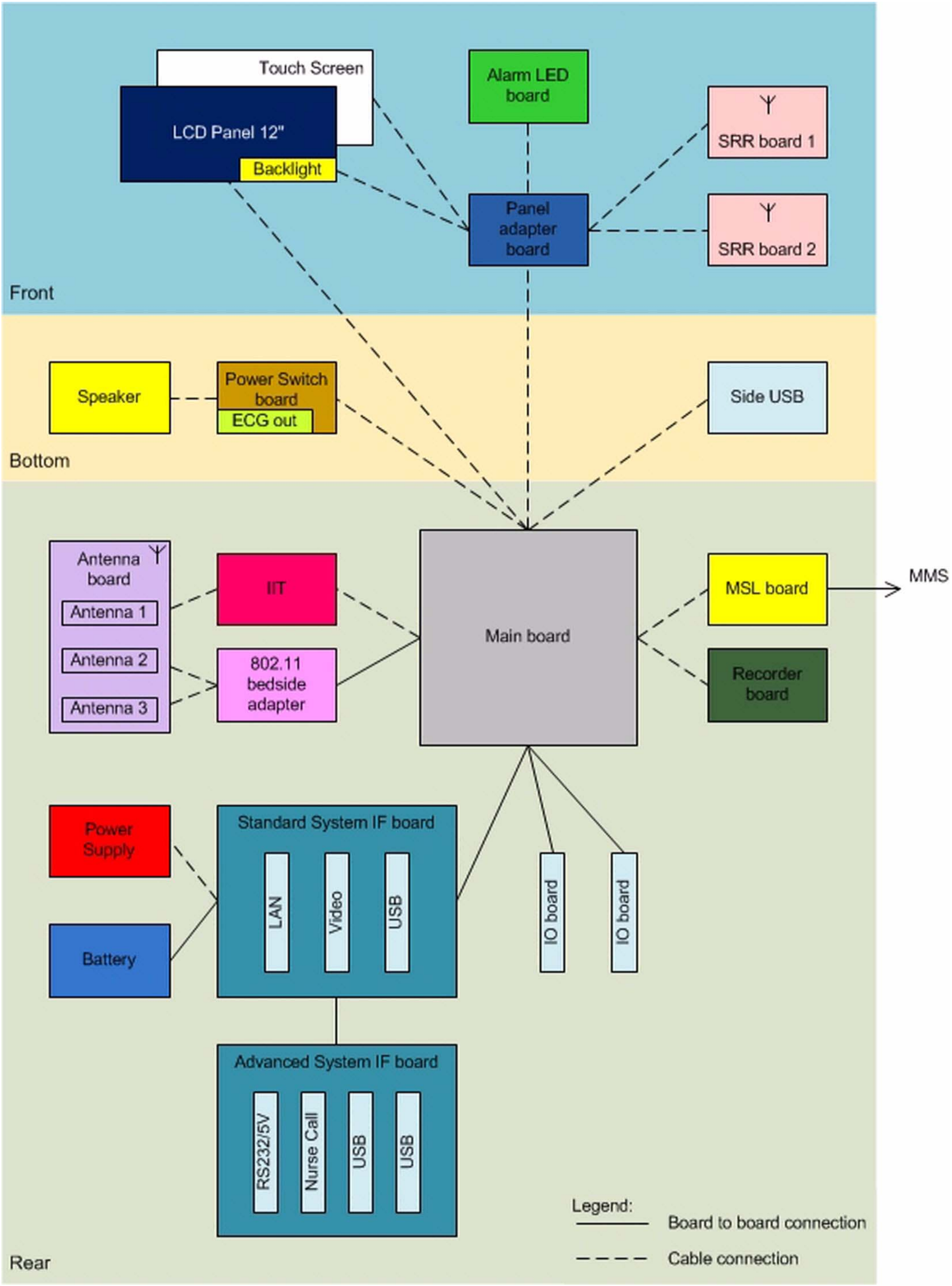
- integrates the display and processing unit into a single package
- uses a 9" TFT WVGA Color display (MX400)
- uses a 12" TFT WXGA Color display (MX450/500)
- uses a 15" TFT WXGA Color Display (MX550)
- uses the touch screen as primary input device; a remote control and computer devices such as mice, trackball, and keyboard can be added optionally.
- has an optional built-in recorder (MX400/450 only)
- has an integrated 3-slot rack (MX500/550 only)

NOTE

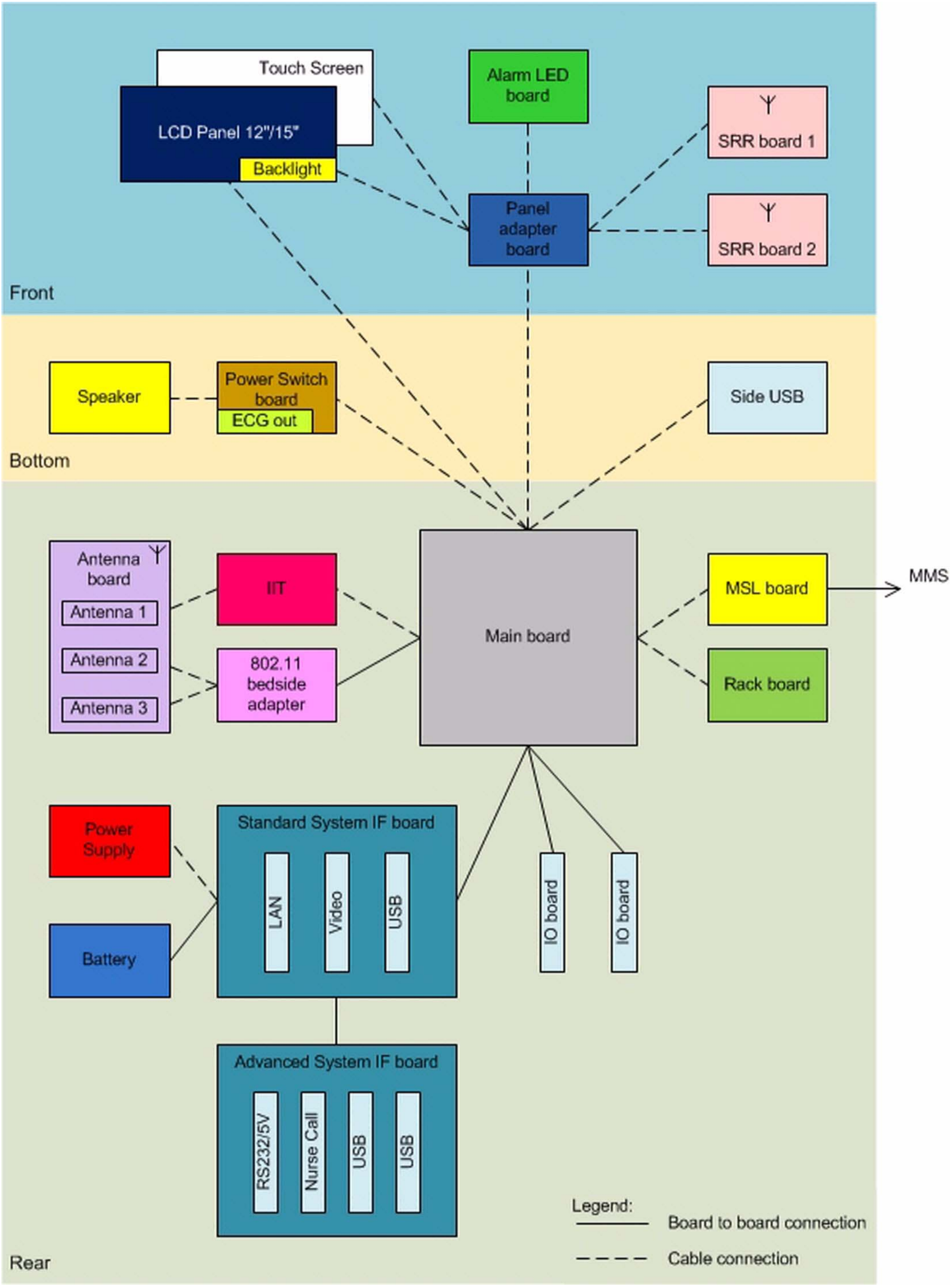
The 802.11 Bedside Adapter (WLAN) and IIT are mutually exclusive.


Touch Screen
LCD Panel 9"
Backlight
Alarm LEDs
Panel adapter board
SRR board 1
SRR board 2
Front
Speaker
Power Switch board
ECG out
Side USB
Bottom
Antenna board
Antenna 1
Antenna 2
Antenna 3
IIT
802.11 bedside adapter
Main board
MSL board
MMS
Recorder board
Power Supply
Battery
Standard System IF board
LAN
Video
USB
IO board
IO board
Advanced System IF board
RS232/5V
Nurse Call
USB
USB
Rear
Legend:
Board to board connection
Cable connection

MX400 Hardware Building Blocks

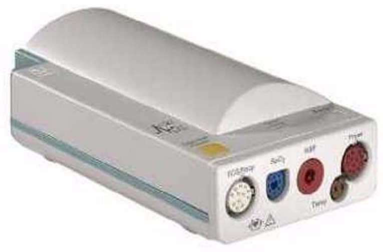

Touch Screen
LCD Panel 12"
Backlight
Alarm LED board
SRR board 1
Panel adapter board
SRR board 2
Front
Speaker
Power Switch board
ECG out
Side USB
Bottom
Antenna board
Antenna 1
Antenna 2
Antenna 3
IIT
802.11 bedside adapter
Main board
MSL board
MMS
Recorder board
Power Supply
Battery
Standard System IF board
LAN
Video
USB
IO board
IO board
Advanced System IF board
RS232/5V
Nurse Call
USB
USB
Rear
Legend:
Board to board connection
Cable connection

MX450 Hardware Building Blocks


Touch Screen
LCD Panel 12"/15"
Backlight
Alarm LED board
SRR board 1
Panel adapter board
SRR board 2
Front
Speaker
Power Switch board
ECG out
Side USB
Bottom
Antenna board
Antenna 1
Antenna 2
Antenna 3
IIT
802.11 bedside adapter
Main board
MSL board
MMS
Rack board
Power Supply
Battery
Standard System IF board
LAN
Video
USB
IO board
IO board
Advanced System IF board
RS232/5V
Nurse Call
USB
USB
Legend:
Board to board connection
Cable connection
Rear

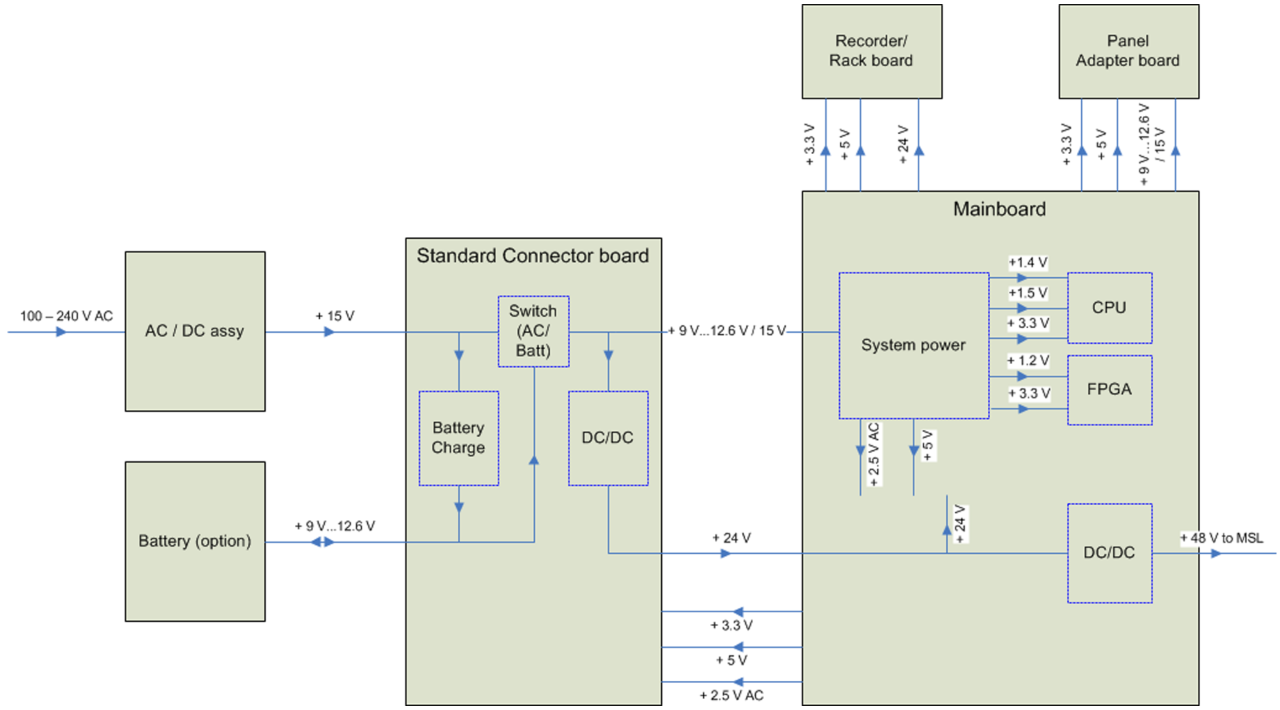
MX500/MX550 Hardware Building Blocks

Compatible Devices

M3001A Multi-Measurement Module (MMS)	
M3002A IntelliVue X2	PHILIPS IntelliVue X2 60 98 121/81 38.1
M3012A MMS Extension	
M3014A MMS Extension	

M3015A/B MMS Extension	
865244 Remote Control	

Power Supply


Recorder/ Rack board
Panel Adapter board
+ 3.3 V
+ 5 V
+ 24 V
+ 3.3 V
+ 5 V
+ 9 V...12.6 V / 15 V
Mainboard
Standard Connector board
100 – 240 V AC
AC / DC assy
+ 15 V
Switch (AC/ Batt)
+ 9 V...12.6 V / 15 V
System power
+1.4 V
+1.5 V
+ 3.3 V
CPU
+ 1.2 V
+ 3.3 V
FPGA
Battery Charge
DC/DC
+ 2.5 V AC
+ 5 V
+ 24 V
Battery (option)
+ 9 V...12.6 V
+ 24 V
DC/DC
+ 48 V to MSL
+ 3.3 V
+ 5 V
+ 2.5 V AC

The AC/DC converter transforms the AC power coming from the plug into 15V/ 70W DC source and isolates the monitoring system from the AC power mains. The 15V is distributed via power bus either directly or over additional converters to all components of the system:

The battery charger is supplied with 15V and switches between AC/DC supply and battery depending on whether AC power cord is plugged or unplugged.

The 48V DC power needed for the MSL is created by an isolating DC/DC converter.

The LED backlight converter located on the panel adapter board is supplied with 9V - 12.6V / 15V.

The isolated interfaces are supplied with 2.5V AC. The main board is supplied with 5V, 3.3V, 1.5V, 1.4V and 1.2V.

Additionally, for some infrastructural functions 3.6V is provided to the main board.

Main Board

The main board contains the CPU which includes the graphic processing unit and USB controller. The main memory, a system FPGA, a system controller including watchdogs and various power supplies are located on this board. Additionally, this board contains the MSL interface, the recorder interface, the ECG Out hardware and various other interfaces.

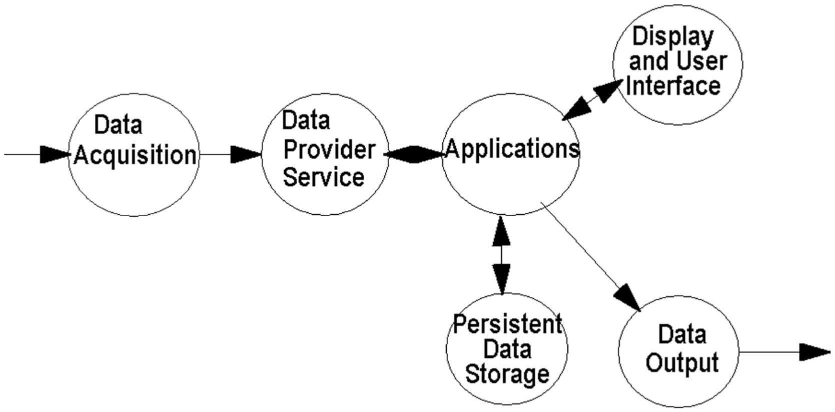
System information is stored in serial EEPROMs to support the automatic configuration of the operating system at boot time.

I/O Boards

A dual MIB/RS232 board, a Flexible Nurse Call Relay board or an IntelliBridge board can be added optionally.

Data Flow

The following diagram shows how data is passed through the monitoring system. The individual stages of data flow are explained below.



Data Flow

Data Acquisition

Monitoring data (for example patient measurement data in the form of waves, numerics and alerts) is acquired from a variety of sources:

- Measurement Servers

  The Measurement Servers connected to the internal LAN convert patient signals to digital data and apply measurement algorithms to analyze the signals.

- External measurement devices

  Data can be also acquired from devices connected to interface boards of the monitor. Software modules dedicated to such specific devices convert the data received from an external device to the format used internally. This applies to parameter modules and the Anesthetic Gas Module.

- Server systems on the Philips Clinical Network

  To enable networked applications such as the other bed overview, data can be acquired from server systems attached to the Philips Clinical Network, for example a Philips Information Center

Data Provider System Service

All data that is acquired from measurement servers or external measurement devices is temporarily stored by a dedicated data provider system service. All monitor applications use this central service to access the data in a consistent and synchronized way rather than talking to the interfaces directly.

This service makes the applications independent of the actual type of data acquisition device.

The amount of data stored in the data provider system service varies for the different data types. For example several seconds of wave forms and the full set of current numerical values are temorarily stored in RAM.

Persistent Data Storage System Service

Some applications require storage of data over longer periods of time. They can use the persistent data storage system service. Dependent on the application requirements, this service can store data either in battery backed-up (buffered) memory or in flash memory. The buffered memory will lose its contents if the monitor is without power (not connected to mains) for an extended period of time. The flash memory does not lose its contents.

The trend application for example stores vital signs data in a combination of flash memory and buffered memory, while the system configuration information (profiles) is kept purely in flash memory.

Display and User Interface Service

Applications can use high level commands to display monitoring data or status and command windows on the internal LCD panel. These commands are interpreted by the display manager application. This application controls the dedicated video hardware.

User input is acquired from a variety of input devices, for example the touchscreen or other standard input devices (keyboard, mouse). The system software makes sure that the user input is directed to the application which has the operating focus.

Data Output

The monitoring system is very flexible and customizable regarding its data output devices. Built-in devices (for example LAN, video) provide the basic output capabilities.

These capabilities can be enhanced by adding additional I/O boards, as required in the specific end-user setup. The additional I/O boards typically provide data to externally attached devices, for example to RS232 based data collection devices.

The monitor can identify I/O boards by means of a serial EEPROM device that stores type and version information. The operating system detects the I/O boards and automatically connects them with the associated (interface driver) application. For some multi-purpose boards it is necessary to configure the board for a particular purpose first (for example the MIB/RS232 board can support external touch display , data import, data export).

Monitor Applications

The monitor applications provide additional system functionality over the basic measurement and monitoring capabilities. This includes for example trending, report generating, event storage or derived measurements.

In general, the monitor applications use the data provider system service to access the measurement data. Application interfaces to the other system services allow the application to visualize data, to store data over extended periods of time or to output data to other devices.

Internal LAN (Measurement Link)

The monitor and multi-measurement modules communicate using an IEEE802.3/ Ethernet LAN in the Measurement Link (MSL). This network is used to distribute data between the components, for example:

- Digitized patient signals including wave data, numerical data and status information (typically from the measurement server to a display unit)

- Control data representing user interactions (typically from the display unit to a measurement server)
- Shared data structures, for example representing patient demographical data and global configuration items

The internal LAN allows plug and play configuration of the monitoring system. The system automatically detects plugging or unplugging of measurement servers and configures the system accordingly.

The components on the internal LAN are time-synchronized to keep signal data consistent in the system. Dedicated hardware support for synchronization eliminates any latency of the network driver software.

The integrated LAN provides deterministic bandwidth allocation/reservation mechanisms so that the real-time characteristic of signal data and control data exchange is guaranteed. This applies to the data flow from the measurement server to the monitor (for example measurement signal data) and the data flow from the monitor to a measurement server (for example to feed data to a recorder module).

Philips Clinical Network

The monitoring system may be connected to the Philips Clinical Network, for example to provide central monitoring capabilities or other network services. This connection may be through a normal wired connection or through a wireless connection.

The monitor supports the connection of an internal wireless adapter (#J35). Switching between wired and wireless networks is automatically triggered by the plugging or unplugging of the network cable.

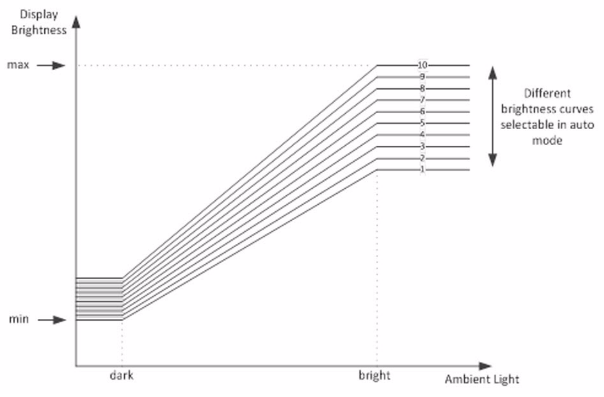
The Philips Clinical Network protocols function very similarly to the protocols used on the internal LAN.

After configuration, the monitoring system sends the digitized patient signals including wave data, numerical data and status information onto the network. Control data representing user interactions can be exchanged between the monitoring system and a central station bi-directionally.

Additional protocols are supported for networked applications, for example for the other bed overview function, which allows viewing of monitoring data from other patients on the network.

For plug and play operation, the monitoring system uses the standard BootP protocol to automatically acquire a network address.

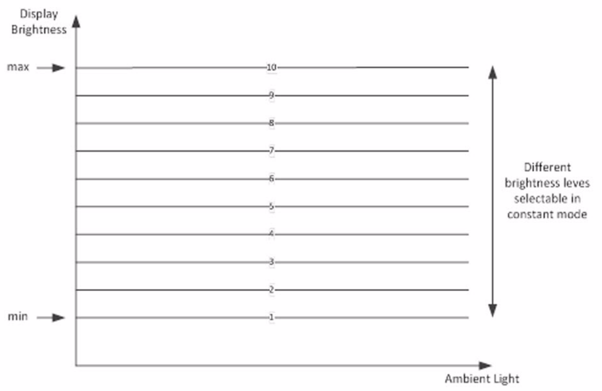
Ambient Light Sensor



The monitor adjusts its display brightness depending on the ambient light level. Therefore an Ambient Light Sensor is integrated in the front bezel of the display.

Although there is an automatic brightness adjustment, it is still possible for the user to change the brightness. As shown in the figure above, the user can select between different brightness level curves.

If a constant brightness is desired, it is possible to deactivate the automatic brightness control via the Config mode of the monitor. Without automatic brightness control, the user can select between different constant brightness levels as shown below.



Microstream CO2

CO2 sample rate: 20 samples/second

Calculation of end tidial CO2 (etCO2)

The M3015A/B MMS Extensions use Microstream® non–dispersive infrared (NDIR) spectroscopy to continuously measure the amount of CO2 during every breath, the amount of CO2 present at the end of exhalation (etCO2), the amount of CO2 present during inhalation (imCO2), and the respiratory rate. The displayed etCO2 is the maximum etCO2 over the previous peak-picking interval as defined by the Max Hold setting (configuration mode). It can be set to no peak picking (off), 10 seconds and 20 seconds.

Test method for respiration rate range

A breath simulator system combined with CO2 and N2 gases was used to simulate respiration rates covering the specified range. The resulting end tidal CO2 values were compared to the expected value. Differences between actual and expected end tidal CO2 values were within the limits of the specified accuracy for the respective respiration rate, i.e. there was no effect of the respiration rate on the end tidal CO2 values beyond those limits.

How does the Support Tool Work with the Monitor

The Support Tool Mark2 is a Windows application typically installed on the laptop of a customer engineer or a biomedical engineer working in the customer's own service department.

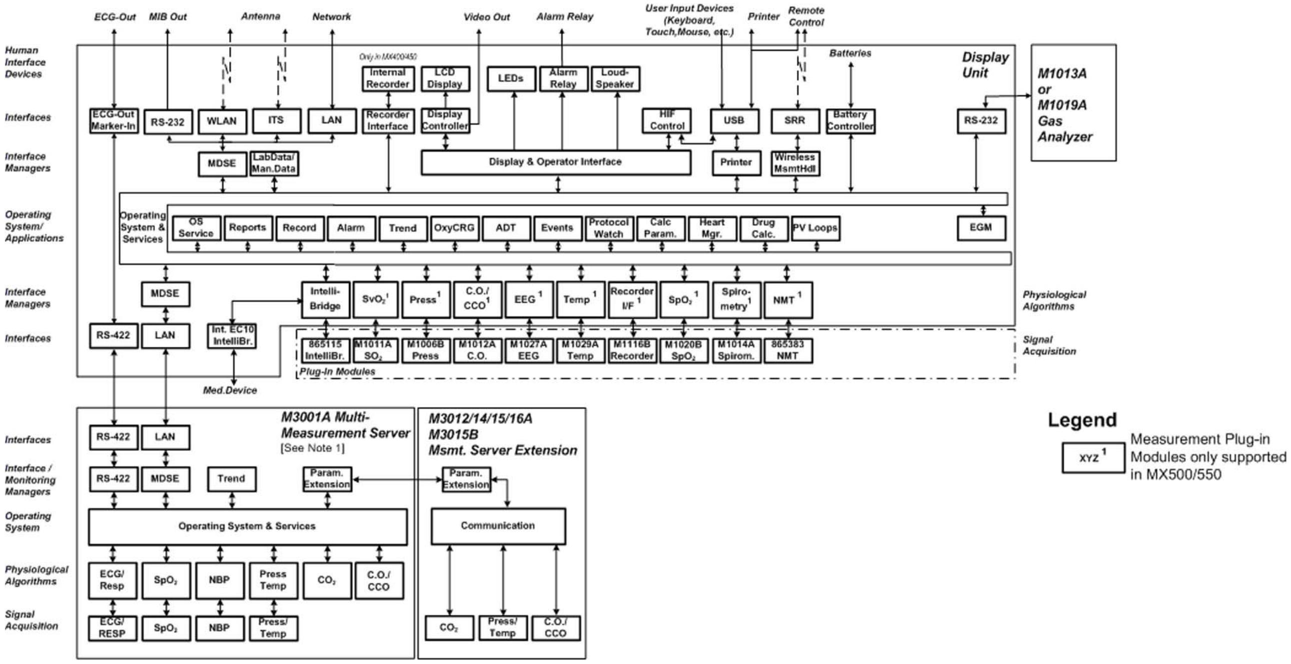
The purpose of the Support Tool Mark2 is to upgrade, configure and diagnose all monitoring components (modules, measurement servers, and monitors) in the system over the network.

The tool allows access to internal service information and to serial numbers. It can be remote-controlled, for example via a dial-up connection from a response center, provided the proper infrastructure is in place.

For details see the Instructions for Use for the Support Tool Mark2.

Monitor Software Block Diagram

MX400/MX450/MX500/MX550 Architecture Design Chart


ECG-Out
MIB Out
Antenna
Network
Video Out
Alarm Relay
User Input Devices (Keyboard, Touch,Mouse, etc.)
Printer
Remote Control
Human Interface Devices
Interfaces
Interface Managers
Operating System/ Applications
Interface Managers
Interfaces
Only in MX400/450
Internal Recorder
LCD Display
LEDs
Alarm Relay
Loud-Speaker
Batteries
Display Unit
M1013A or M1019A Gas Analyzer
ECG-Out Marker-In
RS-232
WLAN
ITS
LAN
Recorder Interface
Display Controller
HIF Control
USB
SRR
Battery Controller
RS-232
MDSE
LabData/ Man.Data
Display & Operator Interface
Printer
Wireless MsmtHdl
Operating System & Services
OS Service
Reports
Record
Alarm
Trend
OxyCRG
ADT
Events
Protocol Watch
Calc Param.
Heart Mgr.
Drug Calc.
PV Loops
EGM
MDSE
Intelli-Bridge
SvO₂¹
Press¹
C.O./ CCO¹
EEG¹
Temp¹
Recorder I/F¹
SpO₂¹
Spiro-metry¹
NMT¹
Physiological Algorithms
RS-422
LAN
Int. EC10 IntelliBr.
865115 IntelliBr.
M1011A SO₂
M1006B Press
M1012A C.O.
M1027A EEG
M1029A Temp
M1116B Recorder
M1020B SpO₂
M1014A Spirom.
865383 NMT
Plug-In Modules
Signal Acquisition
Med.Device
Interfaces
Interface / Monitoring Managers
Operating System
Physiological Algorithms
Signal Acquisition
M3001A Multi-Measurement Server [See Note 1]
RS-422
LAN
RS-422
MDSE
Trend
Param. Extension
Operating System & Services
ECG/ Resp
SpO₂
NBP
Press Temp
CO₂
C.O./ CCO
ECG/ RESP
SpO₂
NBP
Press/ Temp
M3012/14/15/16A M3015B Msmt. Server Extension
Param. Extension
Communication
CO₂
Press/ Temp
C.O./ CCO
Legend
XYZ¹
Measurement Plug-in Modules only supported in MX500/550

Note 1: In addition to the M3001A Multi- Measurement Server, the M3002A Multi- Measurement Server is also supported.

Block Diagram Legend

Functional Block	Description
Services	
Operating System	The Operating System (OS) provides a layer of isolation between the specific hardware implementation and the application software. The OS performs system checks and allocates resources to ensure safe operation when the system is first started. This includes internal self-tests on several hardware modules and configuration checks for validity of configuration with the operating software. During normal operation, the OS continues to run checks on system integrity. If error conditions are detected the OS will halt monitoring operations and inform the operator about the error condition.

Functional Block	Description
System Services	The System Services provide generic common system services. In particular: They use a real-time clock component to track time. They synchronize to network time sources and verify the accuracy of the system time information. They are also responsible for managing persistent user configuration data for all Measurement Servers and IntelliVue Patient Monitoring System software modules. User configuration data is stored in a non-volatile read/write storage device
Applications	
Reports	The Reports Service retrieves current and stored physiological data and status data to format reports for printing paper documentation. The following reports are supported: • Vital Signs Report • Graphical Trend Report • Event Review Report • Event Episode Report • ECG Report (12 Lead/Multi-Lead) • Cardiac Output Report • Calculations Report (Hemodynamic/Oxygenation/ Ventilation) • Calculations Review Report • Wedge Report • Test Report • Other reports (e.g. Loops, Review Applications, Drug report) The Reports service generates report data which can be printed on a local or a central printer.
Record	The Record Service retrieves current and stored physiological data and status data to format a continuous strip recording. A recording can be triggered manually by the operator or automatically by an alarm condition. The Record Service can also send data to a recorder.

Functional Block	Description
Alarm	The Alarm Service contains logic that prioritizes alarm conditions that are generated either by the Measurement Servers or by IntelliVue Patient Monitoring System software modules. Visual alarm signals (messages) are displayed at the top of the IntelliVue Patient Monitoring System display and alarm sounds are generated by a loudspeaker. Alarm conditions may be generated when a physiological parameter exceeds preselected alarm limits or when a physiological parameter or any other software module reports an inoperative status (technical alarm, for example, the ECG leads may have fallen off the patient). The Alarm service manages the alarm inactivation states, for example suspension of alarms, silencing of alarms, and alarm reminder. Alarm signals may also be configured as latching (alarm signals are issued until they are acknowledged by the operator, even when the alarm condition is no longer true). The Alarm service controls the visual alarm signals (alarm lamps).
Trend	The Trend service stores the sample values of physiological data and status data with a resolution of 12 seconds, 1 minute or 5 minutes for a period of up to 48 hours. The data is kept in battery buffered read/write storage and flash memory devices to be preserved across power failures. The stored data is protected via consistency checks and checksums. When a new patient is admitted, the trend database erases all data of the previous patient.
OxyCRG	The OxyCRG (Oxygen CardioRespiroGram) service derives a high-resolution trend graph from the Beat-to-Beat Heart Rate, SpO2 or tcpO2, and Respiration physiological data. The OxyCRG is specialized for neonatal applications, allowing the operator to identify sudden drops in Heart Rate (Bradycardia) and SpO2 or tcpO2 (Desaturations), and supporting the operator in visualizing Apnea situations.
ADT	The ADT (Admit/Discharge/Transmit) service maintains the patient demographics information. The operator may admit a new patient, discharge the old patient and enter or modify the patient demographics. The ADT service also supports the transport of a patient (trend database) with the M3001A Multi-Measurement Module. The ADT service controls the deletion of old patient data, the upload of trend data from the M3001A and the switching back of all settings to user defaults. It also synchronizes patient information with a central station on the network.
Events	The Events Application captures physiological data from episodes for later review and documentation purposes. Events can be triggered automatically by an alarm condition, by user-defined conditions or manually by the operator.

Functional Block	Description
Protocol Watch	ProtocolWatch allows the execution of pre-defined clinical protocols in the IntelliVue patient monitor by combining events such as automatically triggered events, time and manually triggered events with textbook knowledge thus aiding the operator to follow clinical guidelines. ProtocolWatch notifies the operator when certain combinations of clinical conditions occur and it documents the developments and clinician actions in a log which can be reviewed on the monitor and documented on a printer.
Calc Param	The Calc Param (Calculated Parameters) service accesses current, stored and manually entered physiological data as input to calculation formulas. With these formulas, derived hemodynamic, oxygenation and ventilation variables are computed. The calculation results, including the input parameters, are stored for later review using the Trend service.
Heart Mgr.	The Heart Manager Application allows the selection of the alarming source to be either heart rate (from ECG) or the system pulse rate. The system pulse rate can be chosen from any of the possible pulse rate sources (e.g., SpO2 and invasive pres-sures). The module implements automatic fall-backs when selected signal sources are not available.
Drug Calc	The Drug Calc application aids in calculating drug dosages for patients.
EGM	EGM (extensible Gas Module) interface aneasthesia gas measurement devices. The EGM Module interfaces the M1013A or M1019A Gas Analyzer devices. The EGM Module retrieves the measurement data and controls the external device. It provides numerical data, wave form data and alarm data for the gas parameters measured by the attached analyzers.
PV Loops	The PV Loops application compares graphic representations of airway waves to help detect changes in the patient airway condition.
Interface Managers	
MDSE	The MDSE (Medical Data Service Element) Interface Manager is responsible for the exchange of real-time data between the IntelliVue Patient Monitoring System display unit and the Measurement Servers as well as between the IntelliVue Patient Monitoring System display unit and other devices attached to the network. MDSE establishes and maintains a data communication link between the devices. It provides configuration information about the remote device to applications in the local device and it allows the exchange of measurement data and status information between the devices.

Functional Block	Description
Printer	The Printer Interface Manager provides a high level interface to a printer. It provides means to: • establish a connection to the printer • transfer data to the printer • get status of the printer • close connection to the printer The Printer Interface Manager also supervises the connection to the printer and whether the printer accepts data (for example paper out). The Printer Interface Manager notifies the operator in such cases.
Display & Operator Interface	The Display and Operator Interface Manager performs the following tasks: • Screen presentation of real-time and stored physiological measurement data, alarm condition data and status information received from the MDSE interface manager, the Alarm service or other IntelliVue Patient Monitoring System modules • Screen presentation of operating controls (control windows) • Processing of operating control commands received from HIF Control interface. The module verifies and interprets the received commands and forwards them to other software modules of the IntelliVue Patient Monitoring System display unit or Measurement Servers • Sound generation (issues audible alarm signals and generates audible information signals, for example QRS and SpO2 tones, operator audible feedback)
LabData/Manual Data	The Laboratory Data/ Manual Data Entry Interface Manager allows acquisition of laboratory data (e.g. acquired by the central station from a laboratory information system). It also allows to manually enter measurement data to make additional, manually acquired measurements available to internal applications and to the system.
Wireless Measurement Manager (WMM)	The WMM Interface Manager provides connectivity to the SRR interface. It establishes communication between SRR enabled devices and the ASW module that manages the data provided by the device
Interfaces	
LAN	The LAN interface implements the physical layer of IEEE 802.3, electrical isolation, and ESD protection. Electronically separated interfaces are used for communication to the Measurement Servers and to the network.
WLAN	The WLAN Interface is a network interface that provides access to an IEEE 802.11 wireless Local Area Network. The configuration of this interface is done by an OS Service.

Functional Block	Description
Display Controller	The display controller is integrated into the CPU. The video RAM is shared with the main memory. The display controller processes the high level display commands (character and graphic generation, wave drawing) and translates them into pixels, which are written into the video RAM, where the display controller generates the video synchronization signals and the pixel stream for the internal and external display.
HIF Control	The HIF (Human Interface Control) interface scans the Human Interface devices for operator controls (Touch Screen, and USB devices), formats the collected data and sends it to the display and Operating Interface.
ECG-Out	The ECG Out interface receives the ECG waveform directly from the ECG/Resp Arrhythmia ST-Segment physiological algorithm via an RS-422 serial interface and converts the digital ECG signal to an analog ECG signal.
Sync Out (ECG)	A pulse signal is provided on the Sync Out connector to allow synchronization with other medical devices.
RS-232	The RS-232 component represents a generic serial communication interface to connect external devices as shown in the diagram, also providing power in MP5, MX400/450/500/550.
RS-422	The serial link RS-422 interface communicates the ECG signal to the ECG Output of the IntelliVue Patient Monitoring System display unit. The interface is a serial, differential, full-duplex link. The interface is ESD protected.
Nurse Call	The Nurse Call has a modular jack 6P6C connector. The connector has an open and close contact on alarm.
MIB	The MIB interface allows full-duplex, short-haul asynchronous binary communication between the monitor and an arbitrary (medical/non-medical) device using an eight-pin RJ45 modular connector. Switching between MIB and RS232 protocol is possible.
IIT Interface	The IIT Interface allows operation of the monitors with IntelliVue Instrument Telemetry
SRR	The SRR interface allows operation of the monitor with an IntelliVue Remote Control.
USB Interface	The USB interface allows connection of USB devices (Mouse, Keyboard, Barcode Scanner, Printer) to the monitor.
Remote Control	The remote control allows remote operation of the monitor via a USB cable or SRR connection.

3

Testing and Maintenance

Introduction

This chapter provides a checklist of the testing and maintenance procedures to ensure the performance and safety of the monitor, the Multi-Measurement Module (MMS), the MMS Extensions and the parameter modules.

These tests must be performed only by qualified personnel certified by the responsible organization. Qualifications required are: training on the subject, knowledge, experience and acquaintance with the relevant technologies, standards and local regulations. The personnel assessing safety must be able to recognize possible consequences and risks arising from non-conforming equipment.

All recurring safety and performance assurance tests must be performed under equal environmental conditions to be comparable.

Preventive Maintenance refers specifically to the series of tests required to make sure the measurement results are accurate. The accuracy and performance procedures are designed to be completed as specified in the following sections or when readings are in question.

For detailed instructions on the maintenance and cleaning of the monitor and its accessories, see *Care and Cleaning, Using Batteries* and *Maintenance and Troubleshooting* in the monitor's *Instructions for Use.*

Terminology and Definitions

The following terms and definitions are used throughout this chapter and taken from the international standards IEC 60601-1, IEC 60601-1-1 and IEC 62353.

- **Medical System**: a medical electrical system is a combination of at least one medical electrical device and other electrical equipment, interconnected by functional connection or use of a multiple portable socket-outlet.
- **Patient Environment:** any area in which intentional or unintentional contact can occur between the patient and parts of the medical system or between the patient and other persons who have had contact with parts of the medical system. The patient environment is defined anywhere within 1.5m (5 feet) of the perimeter of the patient's bed and 2.5m (8.2 feet) from the floor.
- **Separation Device/Transformer:** a component or arrangement of components with input parts and output parts that, for safety reasons, prevent a transfer of unwanted voltage or current between parts of a medical system.
- **Multiple Portable Socket-Outlet:** a combination of two or more socket-outlets intended to be connected to or integrated with flexible cables or cords, which can easily be moved from one place to another while connected to the power mains.

- **Functional Connection:** an electrical connection for transfer of signals and/or power.
- **Tests:** Safety or Performance Assurance test procedures which may consist of several steps.

Recommended Frequency

Perform the procedures as indicated in the suggested testing timetable. These timetable recommendations do not supersede local requirements.

Table 1 Suggested Testing Timetable

Tests		**Frequency**
Preventive Maintenance*	NBP Performance	Once every two years, or more often if specified by local laws.
	Microstream CO_2 Calibration	**Once a year** or after **4000 hours** of continuous use and following any instrument repairs or the replacement of any instrument parts.
Other Regular Tests	Visual Inspection	Before each use.
	Power On Test	
Performance Assurance Tests	ECG/Resp Performance	Once every two years, or if you suspect the measurement is incorrect, except Mainstream CO_2 Accuracy Check, Sidestream CO_2 Accuracy Check and Flow Check - required once a year.
	ECG Out Performance	
	SpO_2 Performance	
	NBP Performance	
	Invasive Pressure Performance	
	Temperature Accuracy	
	M3014A Capnography Extension Performance Tests	
	Microstream CO_2 Performance Test	
	Spirometry Accuracy Test	
	C.O. Performance	
	NMT Performance	
	IntelliBridge Performance Test	
	Nurse Call Relay Performance	
	MSL Assurance Test	
	Power Loss Alarm Buzzer Performance Test	
	Recorder M1116C Performance Test	
	Mounting Integrity Test	

Tests			**Frequency**
Safety Tests	**Visual**	Visual Inspection	After each service event
	Electrical	Protective Earth	Once every two years and after repairs where the power supply has been removed or replaced or the monitor has been damaged by impact.
		Equipment Leakage Current	
		Applied Part Leakage Current	
		System Test	Once every two years

NOTE

The EEG parameter does not require performance testing. See “EEG, SvO2 (SO2) and tcGas Performance Tests” on page 84 for details.

When to Perform Tests

This table tells you when to perform specific tests.The corresponding test procedures are described in the following sections **All tests listed below must be performed on the monitor itself and any attached MMS/X2 and parameter modules.**

Table 2 When to perform tests

Service Event **(When performing...**	**Tests Required** **...Complete these tests)**
Installation	
Installation of a monitor in combination with a medical or non-medical device connected to the same multiple socket outlet.	Perform Visual Inspection, Power On and System Tests
Installation of a monitor with **no** display connected to the video output	Perform Visual Inspection and Power On Test
Installation of a monitor with a medical display specified by Philips	Perform Visual Inspection and Power On Test
Installation of a monitor with an off-the-shelf display (non-compliant with IEC 60601-1)	Perform Visual Inspection, Power On and System Test (per each affected video port)
Installation of a monitor with IntelliVue G1/G5, connected to separate mains sockets.	Perform Visual Inspection and Power On Tests
Installation of a monitor with an IntelliBridge connection to another medical device (compliant with IEC 60601-1), connected to separate mains sockets.	Perform Visual Inspection and Power On Tests
Installation of a monitor with recorder module M1116C	Perform Visual Inspection, Power On and Recorder Performance Test
Installation of a monitor with IT equipment e.g. printer, PC connected via a functional connection USB.	Perform Visual Inspection, Power On and System Tests

Service Event **(When performing...**	**Tests Required** **...Complete these tests)**
Installation of monitor with IntelliVue 802.11 Bedside Adapter	Perform Visual Inspection, Power On and IntelliVue 802.11 Bedside Adapter Communication Test
Installation of a monitor with IntelliVue Instrument Telemetry	Perform Visual Inspection, Power On and IIT Communication Test
Installation of monitor with Short Range Radio (SRR)	Perform Visual Inspection, Power On and SRR Communication Test.
Installation of networked monitor (LAN)	Perform Visual Inspection and Power On Test
Preventive Maintenance	
Preventive Maintenance*	Perform preventive maintenance tests and procedures: NBP calibration Microstream CO_2 calibration
Other Regular Tests and Tasks	
Visual Inspection	Perform Visual Inspection
Power On Test	Perform Power On test
Repairs	
Repairs where the monitor, parameter modules, MMS or X2 have been damaged by impact, liquid ingression, fire, short circuit or electrical surge.	Perform Visual Inspection, Power On, all Safety Tests and Full Performance Assurance Tests
Repairs where the power supply, the mains socket or an interface board of the monitor is removed or replaced or the protective earth ground connection is disrupted.	Perform Visual Inspection, Power On, all Safety Tests and Basic Performance Assurance Test
Repairs of IntelliVue 802.11 Bedside Adapter	Perform Visual Inspection, Power On and IntelliVue 802.11 Bedside Adapter Communication Test
Repairs of IntelliVue Instrument Telemetry (IIT) Module	Perform Visual Inspection, Power On and IIT Communication Test
Repairs of Short Range Radio (SRR) Interface	Perform Visual Inspection, Power On and SRR Communication Test
Repairs of the parameter modules, MMS or X2 (all service events where the parameter modules MMS or X2 have been opened)	Perform Visual Inspection, Power On, all Safety Tests and Basic Performance Assurance Test. If a certain parameter seems suspicious, perform Full Performance Assurance Test for this parameter.
Repairs where the NBP pump of the MMS or X2 has been replaced	Perform Visual Inspection, Power On, all Safety Tests, Basic Performance Assurance Test and NBP Performance Test and Calibration
Repairs where the parameter module, MMS or X2 has been replaced.	Perform Visual Inspection, Power On and Basic Performance Assurance

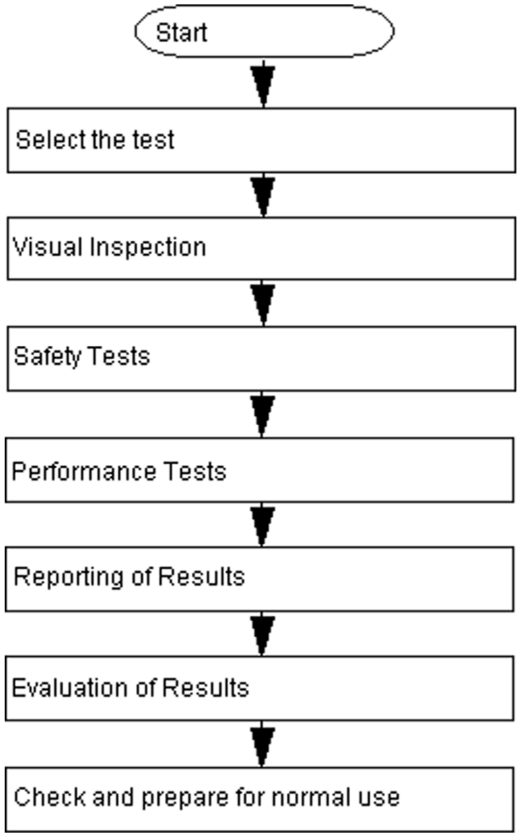
Service Event **(When performing...**	**Tests Required** **...Complete these tests)**
Repairs where the recorder module M1116C has been replaced or repaired.	Perform Visual Inspection, Power On and Recorder Performance Test
Repairs of the IntelliVue G1/G5	Perform Basic Performance Assurance Test. For further testing requirements, see IntelliVue G1/G5 Service Guide
Repairs where the printer connected to the monitor via connector board has been replaced.	Perform Visual Inspection, Power On, System Test and Printer Test.
All other IntelliVue Monitoring System repairs (except when power supply is removed)	Perform Visual Inspection, Power On Test and Basic Performance Assurance Test
Performance Assurance	
Basic Performance Assurance	Perform basic performance assurance tests for the respective monitoring system component.
Full Performance Assurance	Perform all accuracy and performance test procedures listed in the following sections. If a particular measurement is in question, perform the measurement performance test only.
Upgrades	
Software **Upgrades**	Perform Visual Inspection, Power On Test and Basic Performance Assurance Test unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade.
Hardware **Upgrades**	Perform Visual Inspection, Power On Test and Basic Performance Assurance Test unless otherwise specified in the Upgrade Installation Notes shipped with the upgrade.
Hardware **Upgrades** where IntelliVue 802.11 Bedside Adapter is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and IntelliVue 802.11 Bedside Adapter Communication Test
Hardware **Upgrades** where IntelliVue Instrument Telemetry (IIT) is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and IIT Communication Test
Hardware **Upgrades** where Short Range Radio (SRR) is installed	Perform Visual Inspection, Power On Test, Basic Performance Assurance Test and SRR Communication Test
Installation of Interfaces or Hardware **Upgrades** where the power supply of the monitor or interface boards of the monitor need to be removed.	Perform Visual Inspection, Power On Test, Basic Performance Tests and all Safety Tests
Combining or Exchanging System Components (non-medical equipment connected to an IntelliVue monitor or medical system equipment operated on a multiple socket outlet)	Perform the System Test for the respective system components

NOTE

It is the responsibility of the facility operator or their designee to obtain reference values for recurring safety and system tests. These reference values are the results of the first test cycles after an installation. You may also purchase this service from Philips.

Testing Sequence

Summary of the recommended sequence of testing:


Start
Select the test
Visual Inspection
Safety Tests
Performance Tests
Reporting of Results
Evaluation of Results
Check and prepare for normal use

NOTE

If any single test fails, testing must be discontinued immediately and the device under test must be repaired or labeled as defective.

Visual Inspection

Before Each Use

Check all exterior housings for cracks and damage. Check the condition of all external cables, especially for splits or cracks and signs of twisting. If serious damage is evident, the cable should be replaced immediately. Check that all mountings are correctly installed and secure. Refer to the instructions that accompany the relevant mounting solution.

After Each Service, Maintenance or Repair Event

Check:

- the integrity of mechanical parts, internally and externally.
- any damage or contamination, internally and externally
- that no loose parts or foreign bodies remain in the device after servicing or repair.
- the integrity of all relevant accessories.

Power On Test

1. Connect the monitoring system to mains and switch it on. This includes connected displays, MMS, MMS Extensions, X2, and parameter modules, gas analyzers and IntelliBridge devices.
2. Make sure that all steps listed in the table *Initial Instrument Boot Phase* in the Troubleshooting section are completed successfully and that an ECG wave appears on the screen.

The expected test result is pass: the monitor boots up and displays an ECG wave. The wave might be a flat line if no simulator is attached.

Safety Tests

Safety tests are comprised of the following tests performed on the monitoring system:

- protective earth resistance
- equipment leakage current
- applied part leakage current
- system test (if applicable)

Safety test requirements are set according to international standards, their national deviations and specific local requirements. The safety tests detailed in this Service Guide are derived from international standards but may not be sufficient to meet local requirements. We recommend that you file the results of safety tests. This may help to identify a problem early particularly if the test results deteriorate over a period of time.

Each individual piece of equipment which has its own connection to mains or which can be connected or disconnected from mains without the use of a tool must be tested individually. The monitoring system as a whole must be tested according to the procedure described in “System Test” on page 52.

Accessories which can affect the safety of the equipment under test or the results of the safety test must be included in the tests and documented.

Warnings, Cautions, and Safety Precautions

- These tests are well established procedures of detecting abnormalities that, if undetected, could result in danger to either the patient or the operator.
- Disconnect the device under test from the patient before performing safety tests.
- Disconnect the device under test from mains before performing safety tests. If this is not possible, ensure that the performance of these tests does not result in danger to the safety analyzer operator, patients or other individuals.
- Test equipment (for example, a *Safety Analyzer*) is required to perform the safety tests. Please refer to Annex C of IEC/EN 62353 for exact requirements for the measurement equipment and for measurement circuits for protective earth resistance and leakage currents. Refer to the

documentation that accompanies the test equipment. Only certified technicians should perform safety testing.

- The consistent use of a *Safety Analyzer* as a routine step in closing a repair or upgrade is emphasized as a mandatory step to maintain user and patient safety. You can also use the *Safety Analyzer* as a troubleshooting tool to detect abnormalities of line voltage and grounding plus total current loads.
- During safety testing, mains voltage and electrical currents are applied to the device under test. Ensure that there are no open electrical conductive parts during the performance of these tests. Avoid that users, patients or other individuals come into contact with touch voltage.
- For Europe and Asia/Pacific, the monitor complies with:
  IEC 60601-1:1988 + A1:1991 + A2:1995(Ed.2); EN60601-1:1990 + A1:1993 + A2:1995(Ed.2); IEC 60601-1-1:2001; EN 60601-1-1:2001; IEC 60601-1-2:2001+A1:2004; EN 60601-1-2:2001+A1:2006.
  For USA, the monitor complies with:
  UL60601-1:2003
  For Canada, CAN/CSA C22.2#601.1-M90+S1+A2
- Local regulations supersede the testing requirements listed in this chapter.
- If a non-medical electrical device is connected to a medical electrical device, the resulting medical electrical system must comply IEC 60601-1-1:2000/ EN 60601-1-1:2001 or IEC 60601-1:2005/ EN 60601-1:2006+A1:2012 (Ed.3) Section 16 "ME Systems"
- Perform safety tests as described on the following pages.

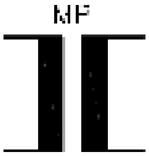
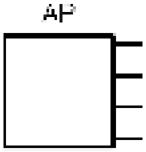
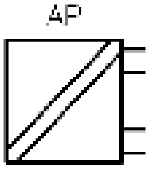
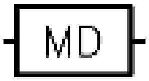
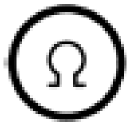
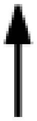
Safety Test Procedures

Use the test procedures outlined here **only** for verifying and recording the initial values prior to or at installation, safe installation or service of the product, and for periodic recurrent testing. The setups used for these tests and the acceptable ranges of values are derived from local and international standards but may not be equivalent. These tests are not a substitute for local safety testing where it is required for an installation or a service event. If using an approved safety tester, perform the tests in accordance with the information provided by the manufacturer of the tester and in accordance with your local regulations, for example IEC/EN 60601-1, UL60601-1 (US), IEC/EN 62353, and IEC/EN 60601-1-1. The safety tester should print results as detailed in this chapter, together with other data.

Please refer to Annex C of IEC/EN 62353 for requirements for the measurement equipment and for measurement circuits for protective earth resistance and leakage currents.

The following symbols are used in the diagrams illustrating the safety tests:

∿	Supply mains	⏚	Protective earth
L, N	Supply mains terminals	PE	Protective earth terminal

	Mains part		Applied part
	F-type applied part		Measuring device
	Resistance measuring device		Connection to accessible conductive parts
....	Optional connection		

CAUTION

After each service, maintenance or repair event:

Ensure all fuses accessible from the outside comply with the manufacturer's specification.

Check:

- the integrity of mechanical parts, internally and externally.
- any damage or contamination, internally and externally.
- that no loose parts or foreign bodies remain in the device after servicing or repair.
- the integrity of all relevant accessories.

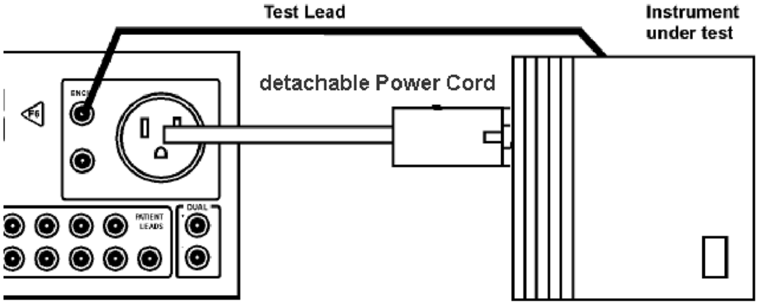
Hints for Correct Performance of Safety Tests

- Perform a visual inspection on all detachable power cords used with the monitoring system and include these in all safety test procedures.
- Connection lines such as data lines or functional earth conductors may appear to act like protective earth connections. These may lead to incorrect measurements and need to be considered during testing. If necessary, unplug these connections.
- During measurements, the device under test shall be isolated from earth (e.g. test on an insulated work bench), except the protective earth conductor in the power supply cord.
- Position all cables and cords in such a manner that they do not influence the safety tests.
- Measurement of insulation resistance is not required.
- When testing a medical electrical system, where possible, test it such that potential ground voltage variations are present as they may be during actual use.

Guideline for Performance of Safety Tests

This section introduces the general principle of performing recurrent safety tests. Product specific test descriptions are described in the following sections.

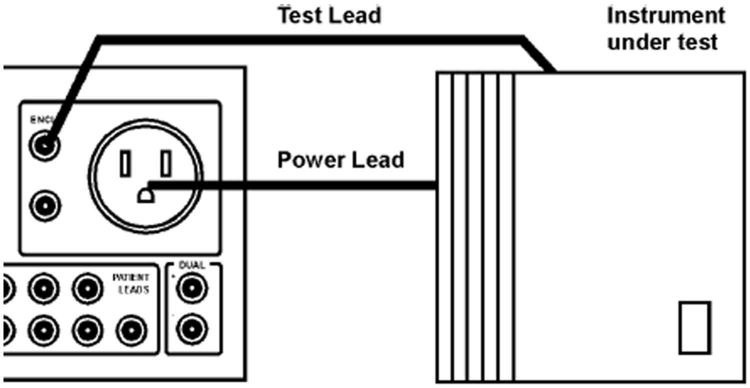
Connect the detachable power cord of the device under test to the safety analyzer's test mains port. Connect the enclosure test lead of the safety analyzer to the enclosure of the device under test, e.g. to the equipotential connector or unearthed conductive accessible parts where applicable during Equipment Leakage Current Tests and Applied Part Leakage Current Tests. For testing the applied part leakage current, connect all applied parts to the safety analyzer using the appropriate patient lead or adapter cable. For the ECG parameter all ten ECG-leads need to be connected to the safety analyzer. If necessary, use an adapter cable to connect all ten ECG-leads. If necessary, repeat the safety test procedure until all available applied parts have been tested. Refer to the documentation that accompanies the safety analyzer for further details on how to set up and perform the test.



Protective Earth Resistance Test - Setup Example

NOTE

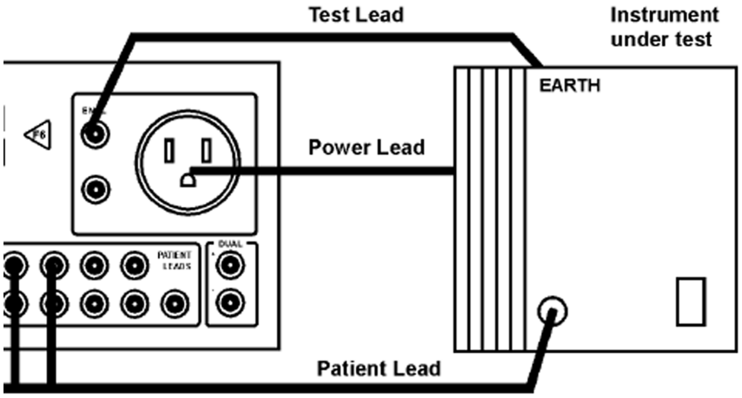
The test lead needs to go to parts that require protective earthing. This may be a single connection or several tested after each other



Equipment Leakage Current Test - Setup Example

NOTE

The test lead needs to go to the grounded enclosure parts, the ungrounded enclosure parts and all of the applied parts connected together.


Test Lead
Instrument under test
EARTH
F6
Power Lead
PATIENT LEADS
DUAL
Patient Lead

Applied Part Current Test - Setup Example

NOTE

The above graphics resemble the Metron QA-90 setup and are protected by copyright. Copyright owned by Fluke (Metron).

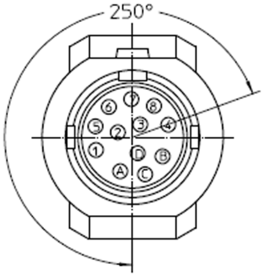
Safety Test Adapter Cable - Schematics

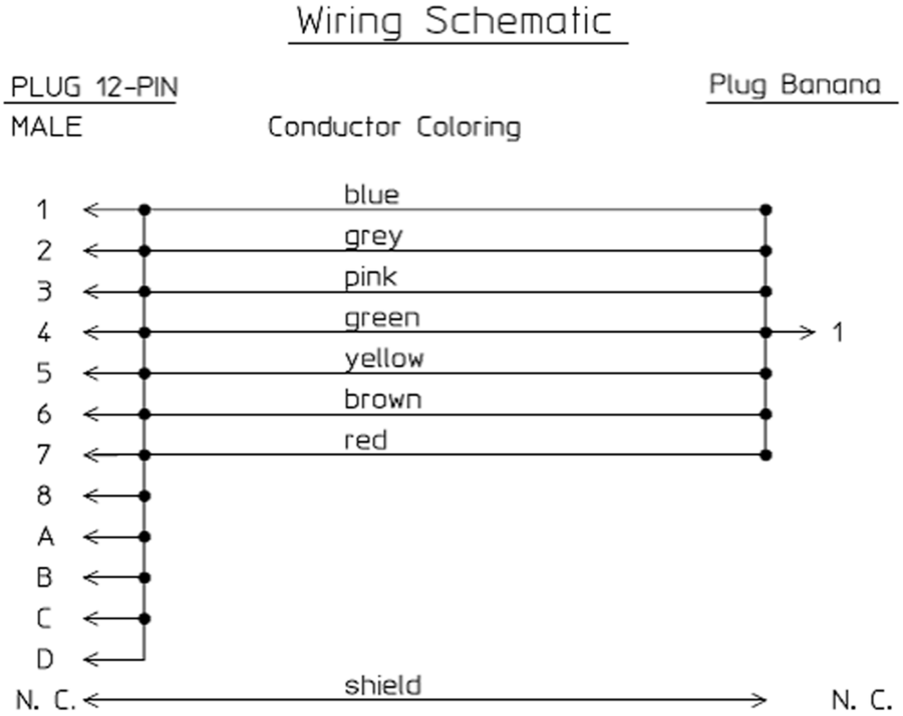
The following graphics provide schematics of safety test (patient lead) adapter cables which can be used for electrical safety testing. These schematics can also be used as a guideline for making your own safety test adapter cables. Alternatively, other methods to make safety test adapter cables can be used, e.g. using a modified accessory cable.

NOTE

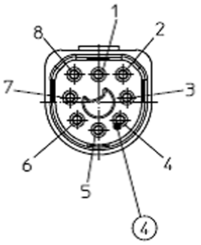
You may not need all of the cables displayed below for electrical safety testing of your respective monitor.

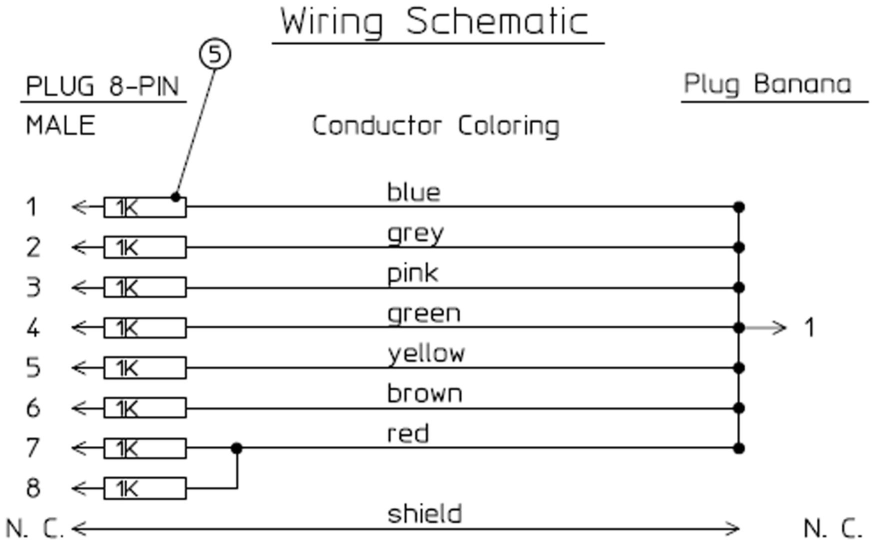
ECG


250°
1
2
3
4
5
6
7
8
A
B
C
D

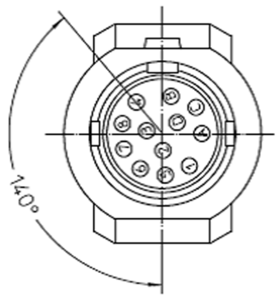

Wiring Schematic
PLUG 12-PIN
MALE
Conductor Coloring
Plug Banana
1
2
3
4
5
6
7
8
A
B
C
D
blue
grey
pink
green
yellow
brown
red
1
N. C.
shield
N. C.

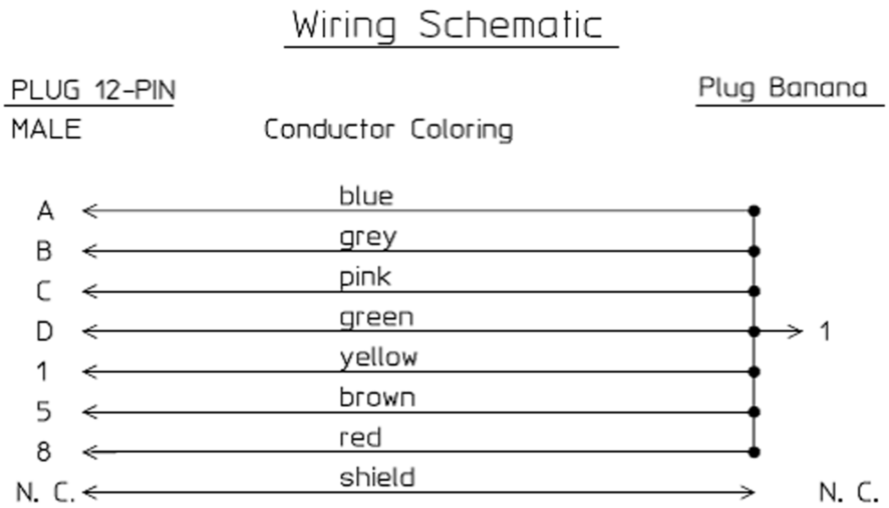
SpO2 (MP2/X2, MP5, M3001A & M1020B #A01, #A02, #A03, #A04)



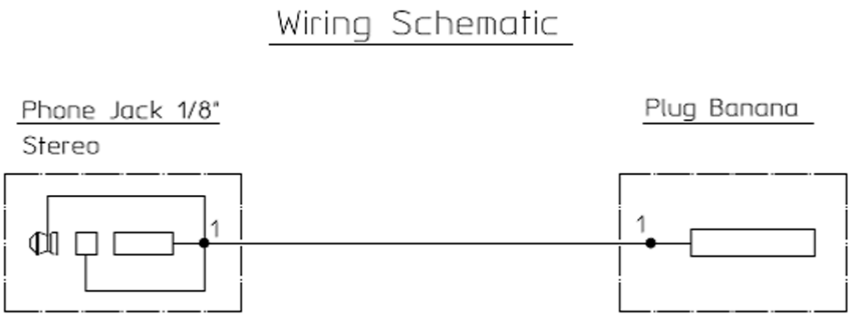

Wiring Schematic
⑤
PLUG 8-PIN
MALE
Conductor Coloring
Plug Banana
1
2
3
4
5
6
7
8
1K
1K
1K
1K
1K
1K
1K
1K
blue
grey
pink
green
yellow
brown
red
1
N. C.
shield
N. C.

Invasive Pressure

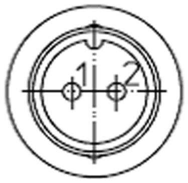


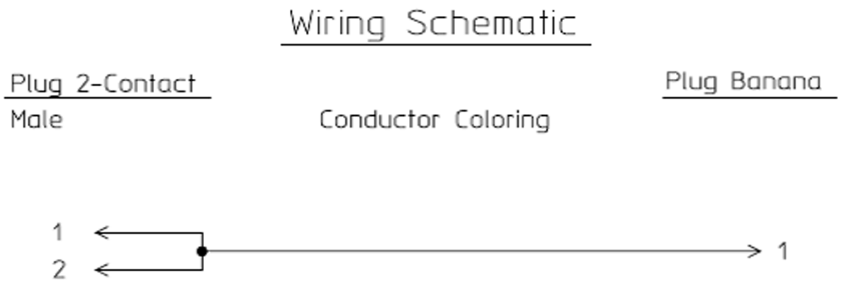

Wiring Schematic
PLUG 12-PIN
MALE
Conductor Coloring
Plug Banana
A
B
C
D
1
5
8
N. C.
blue
grey
pink
green
yellow
brown
red
shield
1
N. C.

Invasive Pressure (M1006B #C01)

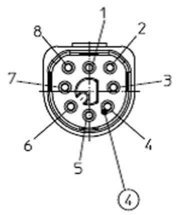

Wiring Schematic
Phone Jack 1/8"
Stereo
1
Plug Banana
1

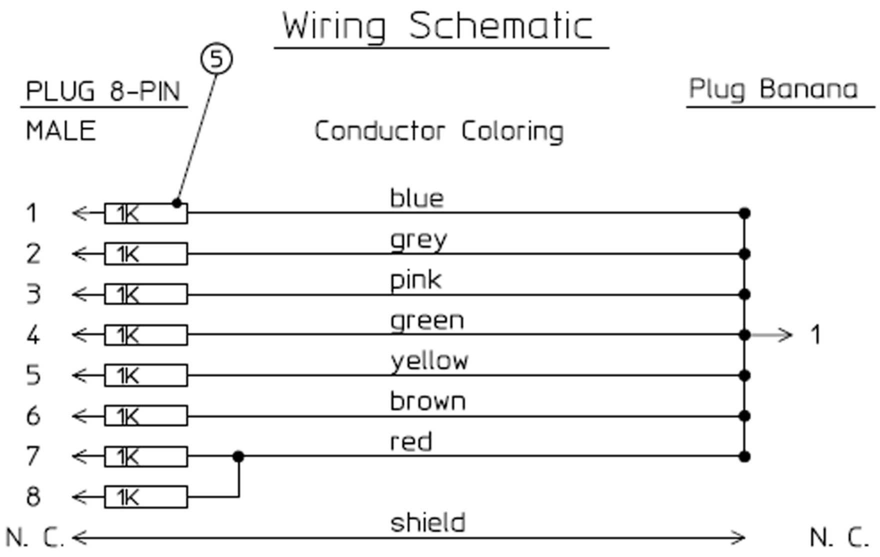
Temperature



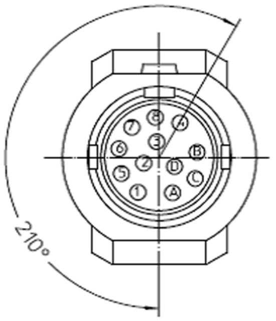

Wiring Schematic
Plug 2-Contact
Male
Conductor Coloring
Plug Banana
1
2
1

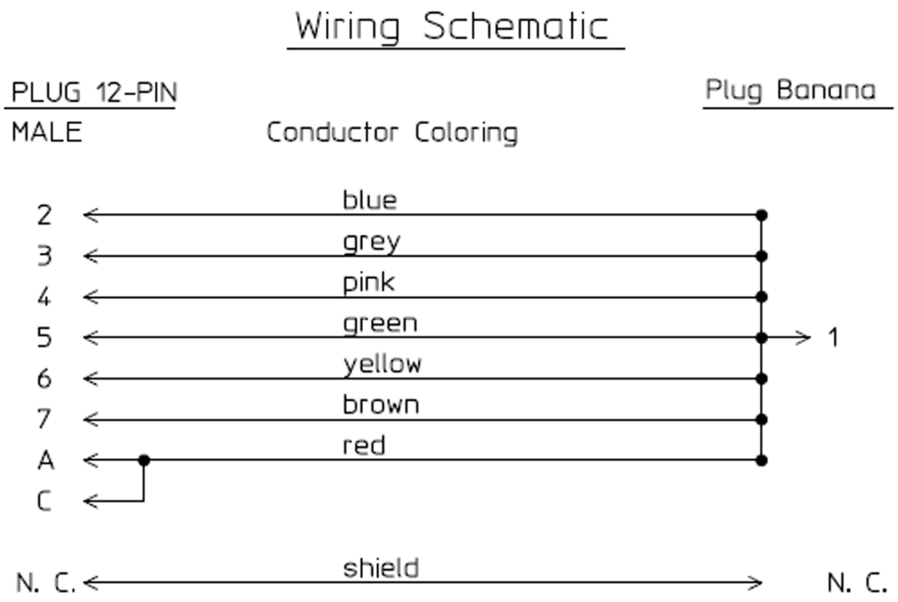
CO2 (MP5, M3014A)


1
2
3
4
5
6
7
8
2
④

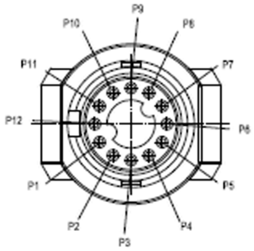

Wiring Schematic
⑤
PLUG 8-PIN
MALE
Conductor Coloring
Plug Banana
1
2
3
4
5
6
7
8
1K
blue
grey
pink
green
yellow
brown
red
shield
1
N. C.
N. C.

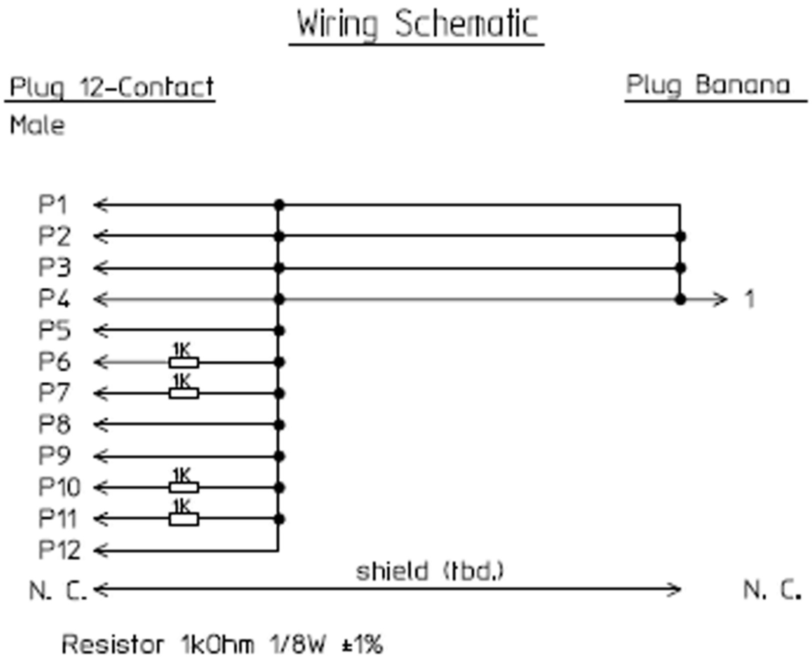
Cardiac Output


210°
1
2
3
4
5
6
7
A
B
C
D

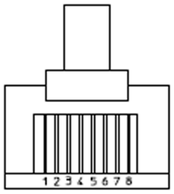

Wiring Schematic
PLUG 12-PIN
MALE
Conductor Coloring
Plug Banana
2
3
4
5
6
7
A
C
blue
grey
pink
green
yellow
brown
red
shield
1
N. C.
N. C.

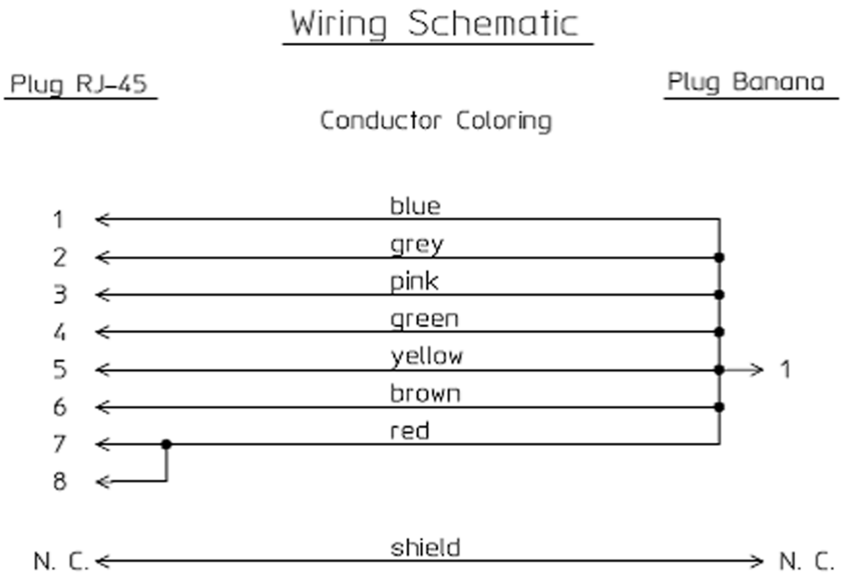
NMT


P9
P10
P8
P11
P7
P12
P6
P1
P5
P2
P4
P3

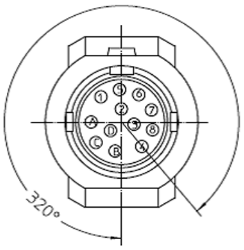

Wiring Schematic
Plug 12-Contact
Male
Plug Banana
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
1K
1K
1K
1K
1
N. C.
shield (tbd.)
N. C.
Resistor 1kOhm 1/8W ±1%

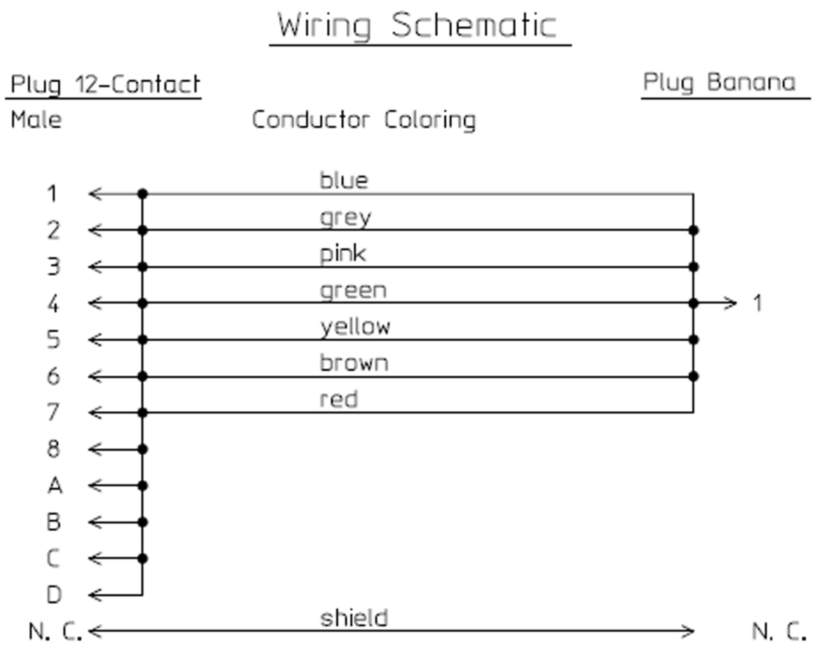
IntelliBridge



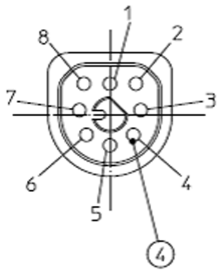

Wiring Schematic
Plug RJ-45
Plug Banana
Conductor Coloring
1
2
3
4
5
6
7
8
blue
grey
pink
green
yellow
brown
red
1
N. C.
shield
N. C.

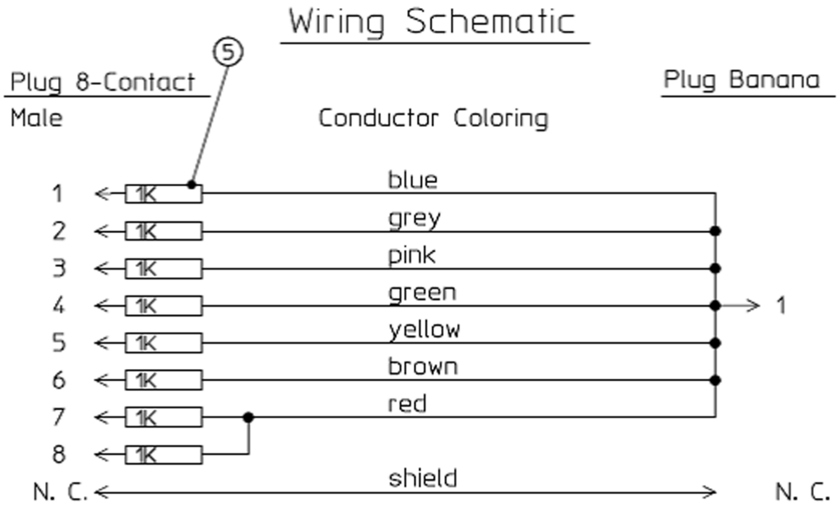
EEG



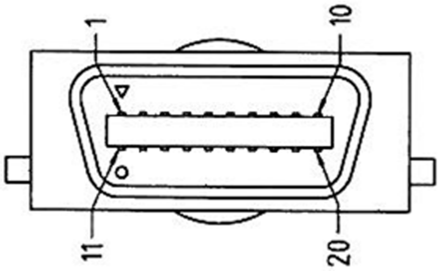

Wiring Schematic
Plug 12-Contact
Male
Conductor Coloring
Plug Banana
1
2
3
4
5
6
7
8
A
B
C
D
N. C.
blue
grey
pink
green
yellow
brown
red
shield
1
N. C.

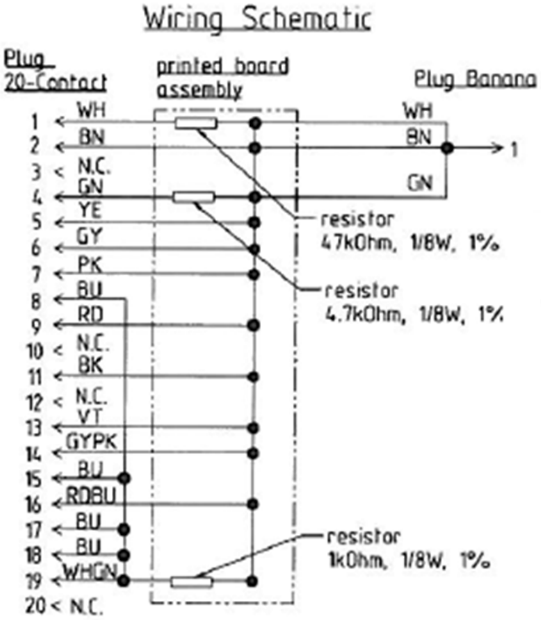
ScVO2 (M1011A)




Wiring Schematic
5
Plug 8-Contact
Male
Conductor Coloring
Plug Banana
1
2
3
4
5
6
7
8
N. C.
1K
blue
grey
pink
green
yellow
brown
red
shield
1
N. C.

TcG10

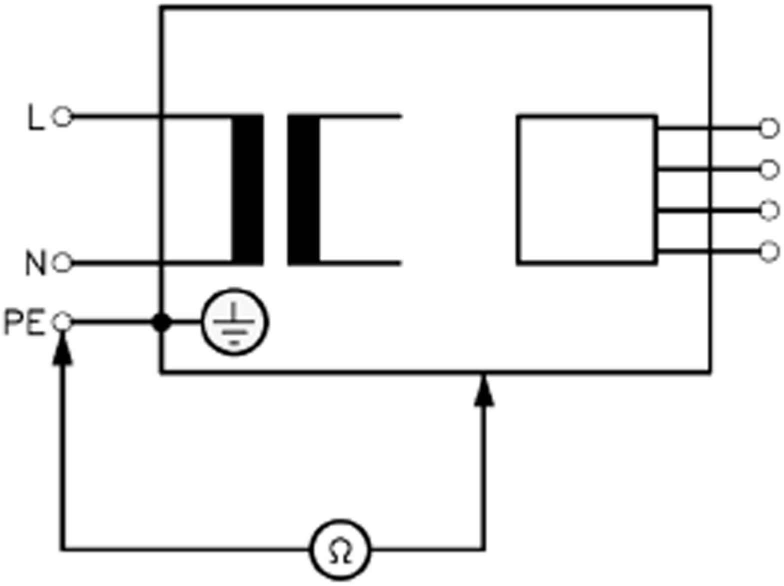



Wiring Schematic
Plug 20-Contact
printed board assembly
Plug Banana
1 WH
2 BN
3 N.C.
4 GN
5 YE
6 GY
7 PK
8 BU
9 RD
10 N.C.
11 BK
12 N.C.
13 VT
14 GYPK
15 BU
16 RDBU
17 BU
18 BU
19 WHGN
20 N.C.
WH
BN
GN
1
resistor 47kOhm, 1/8W, 1%
resistor 4.7kOhm, 1/8W, 1%
resistor 1kOhm, 1/8W, 1%

Electrical Safety Testing

S(1): Protective Earth Resistance Test

Test to perform:



Measuring circuit for the measurement of Protective Earth Resistance in medical electrical equipment that is disconnected from the supply mains.

This measures the impedance of the Protective Earth (PE) terminal to all exposed metal parts of the Device under Test (DUT), which are for safety reasons connected to the Protective Earth (PE).

You can find metal parts of the device at the equipotential connector.

Measurements shall be performed using a measuring device capable to deliver a current of at least 200 mA into 500 mOhms with maximum open circuit voltage of 24V

This safety test is based on IEC/EN 62353.

Report the highest value (X1).

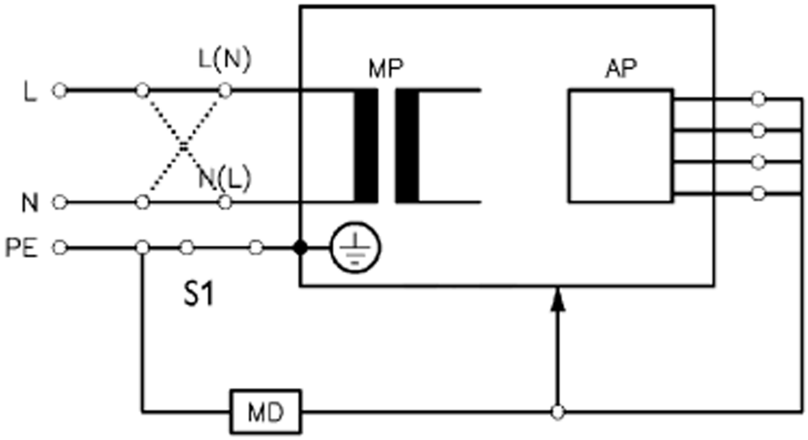
Test	Expected test results
Protective Earth Resistance Test (with mains cable)	X1 <= 300mOhms

NOTE

- If the protective earth resistance test fails, testing must be discontinued immediately and the device under test must be repaired or labeled as defective.
- All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.
- Flex the power cord during the protective earth resistance test to evaluate its integrity. If it does not pass the test, exchange the power cord. Then repeat the test. If it still does not pass, follow the instructions in the first bullet point of this note above.

S(2): Equipment Leakage Current Test - Normal Condition

Test to perform:



Measuring circuit for the measurement of Equipment Leakage Current - *Direct method* **according to IEC/EN 62353.**

This test measures leakage current of accessible conductive and non-conductive metal parts of the monitor and the functional earth leakage current. It tests normal and reversed polarity. Perform the test with S1 closed (Normal Condition).

There are no parts of the equipment that are not protectively earthed. Disconnect any data cables and any connections that may provide an extraneous earth path. Test the device under test (DUT) on an insulated surface. Do not touch the DUT during testing.

This safety test is based on IEC/EN 62353.

Report the highest value (X1).

Test	Expected test results
Equipment Leakage Current Test (Normal Condition - with mains cable)	X1 <= 100µA

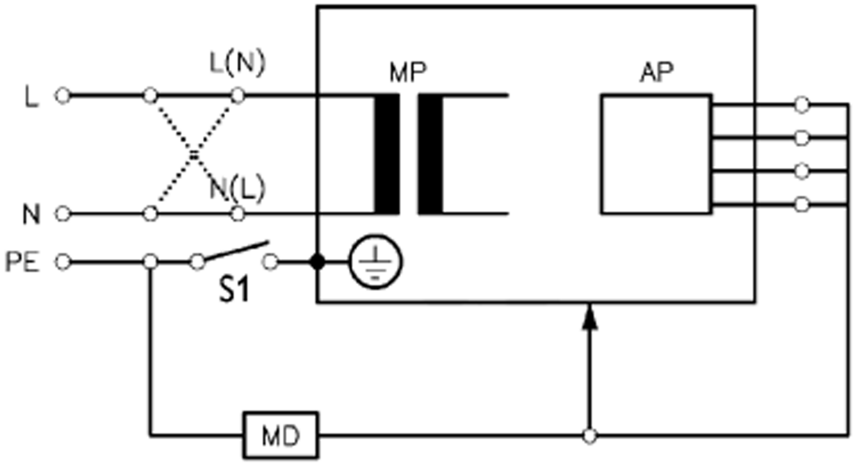
NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

S(3): Equipment Leakage Current Test - Single Fault Condition

Test to perform:



Measuring circuit for the measurement of Equipment Leakage Current - *Direct method* **according to IEC/EN 62353.**

This test measures leakage current of accessible conductive and non-conductive metal parts of the monitor and the functional earth leakage current. It tests normal and reversed polarity. Perform the test with S1 open (Single Fault Condition).

There are no parts of the equipment that are not protectively earthed. Disconnect any data cables and any connections that may provide an extraneous earth path. Test the device under test (DUT) on an insulated surface. Do not touch the DUT during testing.

This safety test is based on IEC/EN 62353.

Report the highest value (X2).

Test	Expected test results
Equipment Leakage Current Test (Single Fault Condition - with mains cable)	X2 <= 300µA

NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

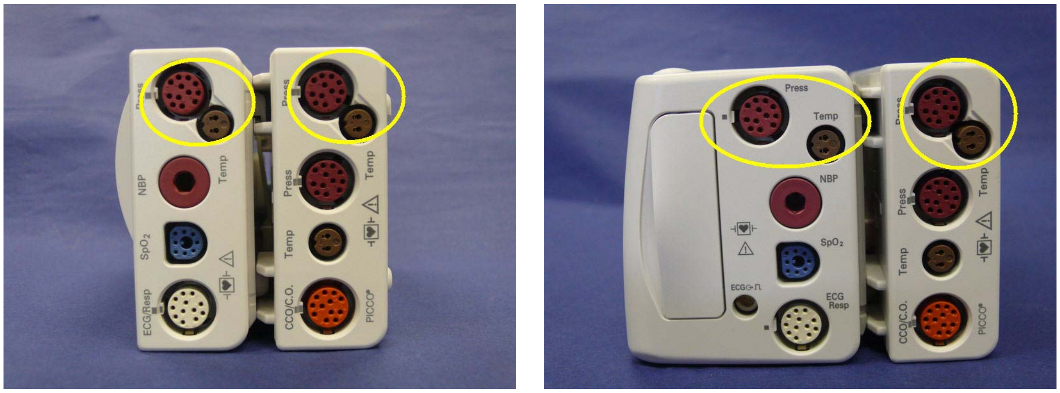
S(4): Applied Part Leakage Current - Mains on Applied Part

NOTE

During measurement of the Applied Part Leakage Current it is possible that the measured current can exceed the allowed limit (per IEC/EN 60601-1 or IEC/EN 62353).

This can occur when the safety tester is connected to the invasive blood pressure and temperature connectors at the same time during the applied leakage current measurement.

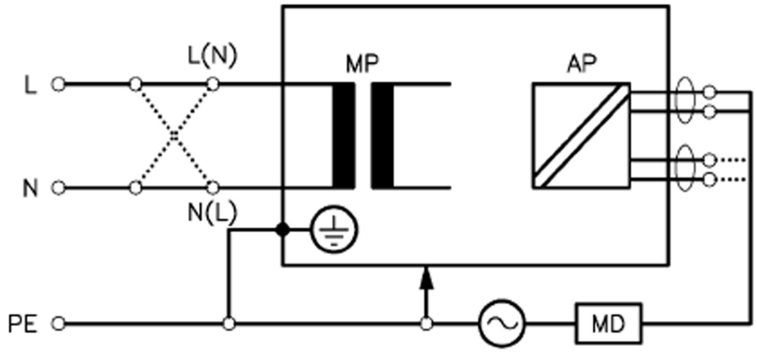
The connectors for the invasive blood pressure and temperature are independently functioning connectors.



Although there are individual connectors on the front end, internally those parameters use the same electrical insulation interface and are hardwired to each other. This results in an electrical short of those connectors during measurement if a test current is applied simultaneously. Therefore this should be avoided.

Due to the combined insulation interface, it is sufficient to connect to only one parameter interface (that is, Invasive Blood Pressure or Temperature) of the invasive blood pressure/temperature measurement block. This avoids a short and the potential of exceeding the limit for the current.

Test to perform:



Measuring circuit for the measurement of Applied Part Leakage Current - *Direct method* **according to IEC/EN 62353.**

This test measures applied part leakage current from applied part to earth caused by external main voltage on the applied part. Each polarity combination possible shall be tested. This test is applicable to each Applied Part tested and results recorded in turn with all other Applied Parts left floating. Applied Parts with multiple connections (e.g. ECG) are tested with the connections short-circuited.

There are no parts of the equipment that are not protectively earthed.

This safety test is based on IEC/EN 62353.

For measurement limits and test voltage, refer to Safety (4) test, Test and Inspection Matrix.

Report the highest value. (X1).

Test	**Expected test results**
Applied Part Leakage Current Test (Single Fault Condition - mains on applied part)	X1 <= 50µA (CF)

NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

In case of an IT-power system, this safety test measurement requires a special measuring circuit, for example with its own integrated TN-system or use of an external isolation transformer attached to the safety test device.

Reference: Allowable Values for IEC 60601-1:1998 and UL 60601-1 Measurements

Protective Earth resistance (between the PROTECTIVE EARTH TERMINAL and any ACCESSIBLE METAL PART which is PROTECTIVELY EARTHED, w/o power cord): 100mOhms

Protective Earth resistance of power cord: 100mOhms

Enclosure leakage current (IEC 60601-1 and UL60601-1): 100 µA (N.C.)

Enclosure leakage current:(IEC 60601-1): 500 µA (S.F.C)

Enclosure leakage current (UL 60601-1): 300 µA (S.F.C)

Patient leakage current: (IEC 60601-1 and UL60601-1): 100 µA (N.C.) for BF

Patient leakage current: (IEC 60601-1 and UL60601-1): 500 µA (S.F.C.) for BF

Patient leakage current: (IEC 60601-1 and UL60601-1): 10 µA (N.C.) for CF

Patient leakage current: (IEC 60601-1 and UL60601-1): 50 µA (S.F.C.) for CF

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated

Insulation Resistance

It is not recommended to perform measurements of the insulation resistance. Refer to IEC 62353 for details about methods of the insulation resistance measurement.

System Test

After mounting and setting up a system, perform system safety tests according to IEC/EN 60601-1-1.

What is a Medical Electrical System?

A medical electrical system is a combination of at least one medical electrical piece of equipment and other electrical equipment, interconnected by functional connection or use of a multiple portable socket-outlet.

- Devices forming a medical electrical system must comply either with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.
- Any electrical device such as IT equipment that is connected to the medical electrical equipment must comply either with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 and be tested accordingly.
- Non-medical electrical equipment may require connection through a separating device (e.g. an isolation transformer).

General Requirements for a System

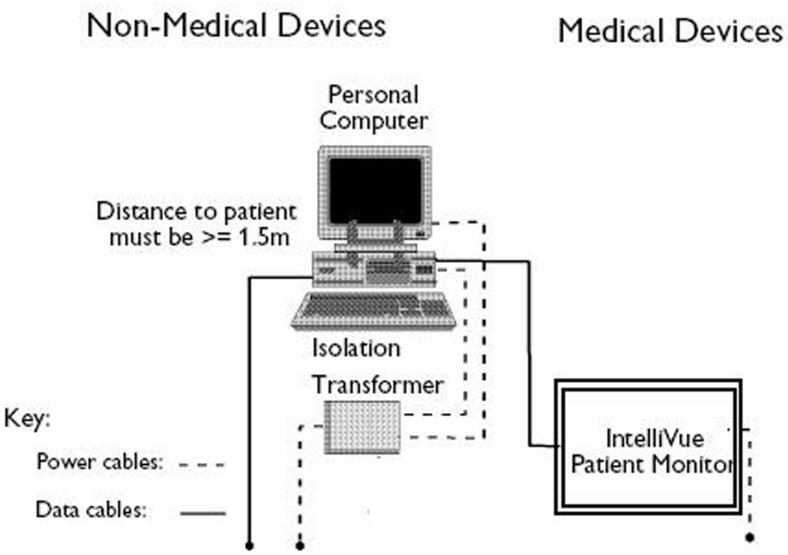
After installation or subsequent modification, a system must comply with the requirements of the system standard IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Compliance is checked by inspection, testing or analysis, as specified in the IEC/EN 60601-1-1 or in this book.

Medical electrical equipment must comply with the requirements of the general standard IEC/EN 60601-1, its relevant particular standards and specific national deviations. Non-medical electrical equipment shall comply with IEC safety standards that are relevant to that equipment.

Relevant standards for some non-medical electrical equipment may have limits for equipment leakage currents higher than required by the standard IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. These higher limits are acceptable only outside the patient environment. It is essential to reduce equipment leakage currents to values specified in IEC/EN 60601-1 when non-medical electrical equipment is to be used within the patient environment.

System Example

This illustration shows a system where both the medical electrical equipment and the non-medical electrical equipment are situated at the patient's bedside.



WARNING

- Do not use additional AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet is used, the resulting system must be compliant with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Do not place multiple socket-outlets on the floor. Do not exceed the maximum permitted load for multiple socket-outlets used with the system. Do not plug additional multiple socket outlets or extension cords into multiple socket outlets or extension cords used within the medical electrical system.
- Do not connect any devices that are not supported as part of a system.
- Do not use a device in the patient vicinity if it does not comply with IEC/EN 60601-1 or IEC 60601-1 edition 3 clause 16. The whole installation, including devices outside of the patient vicinity, must comply with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Any non-medical device placed and operated in the patient's vicinity must be powered via a separating transformer (compliant with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16) that ensures mechanical fixing of the power cords and covering of any unused power outlets.

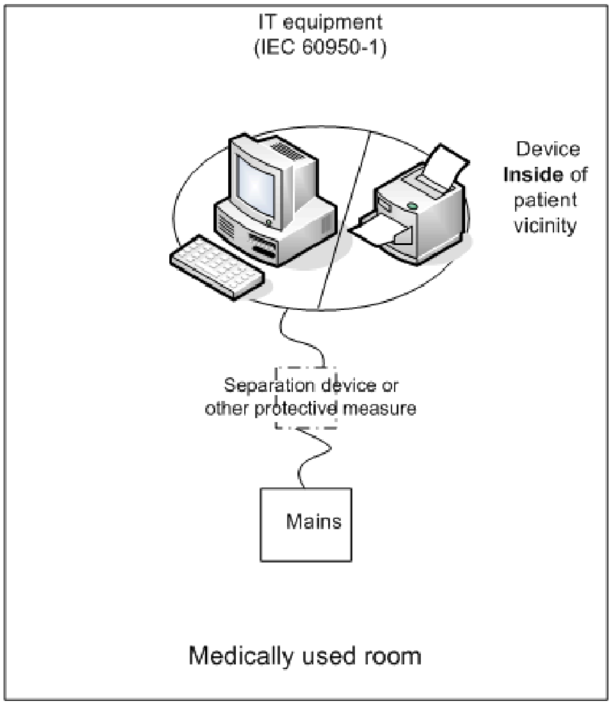
System Installation Requirements

- Ensure that the medical electrical system is installed in a way that the user achieves optimal use.
- Make sure the user is informed about the required cleaning, adjustment, sterilization and disinfection procedures listed in the Instructions for Use.
- The medical electrical system must be installed in such a way that the user is able to carry out the necessary cleaning, adjustment, sterilization and disinfection procedures listed in the Instructions for Use.

- Ensure that the medical electrical system is installed in a way that an interruption and restoration of power to any part of the medical electrical system does not result in a safety hazard.
- We recommend using fixed mains socket outlets to power the medical system or parts thereof. Avoid using multiple portable socket-outlets.
- Any multiple portable socket outlets used must be compliant with IEC 60884-1 and IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.
- Ensure that any part of the system connected to multiple portable socket-outlets is only removable with a tool, i.e. the multiple portable socket-outlet provides a locking mechanism to prevent power cords from being plugged or unplugged unintentionally. Otherwise, the multiple portable socket-outlet must be connected to a separation device. Multiple Socket Outlets used within the medical electrical system must only be used for powering medical electrical equipment which is part of the system.
- Ensure that any functional connections between parts of the medical electrical system are isolated by a separation device according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 to limit increased equipment leakage currents caused by current flow through the signal connections where necessary (e.g. leakage current coming from non-medical electrical equipment into medical electrical equipment or building ground voltage differences providing leakage current through grounded data cables). This only works if the equipment leakage current of the respective medical electrical system parts is not exceeded under normal conditions. This isolation is especially important where the non-medical electrical equipment leakage currents can pass to the medical electrical equipment in the system or building ground voltage differences can pass to the medical electrical equipment via ground in a data cable connection in the system
- Avoid increase of equipment leakage currents when non-medical electrical equipment within the medical electrical system is used. This only applies when if the equipment leakage current of the respective medical electrical system parts is not exceeded under normal conditions. Use of an additional protective earth connection, separation device or additional non-conductive enclosures are options that can prevent a problem.
- Within the patient environment it is important to limit electrical potential differences between different parts of a system. If necessary, use potential equalization equipment (equipotential cable) or additional protective earth connections.
- Medical electrical equipment used in medical rooms must be connected to potential equalization equipment (equipotential cable) to avoid electrical potential differences. Check your local requirements for details.

Required Protective Measures at System Installation

For any IT equipment (IEC60950-1) operated in the patient environment ensure that the equipment leakage current does not exceed the limits described in IEC 60601-1. Use a separation device to ensure compliance. After installation of IT equipment in the patient environment, an equipment leakage current test is required.

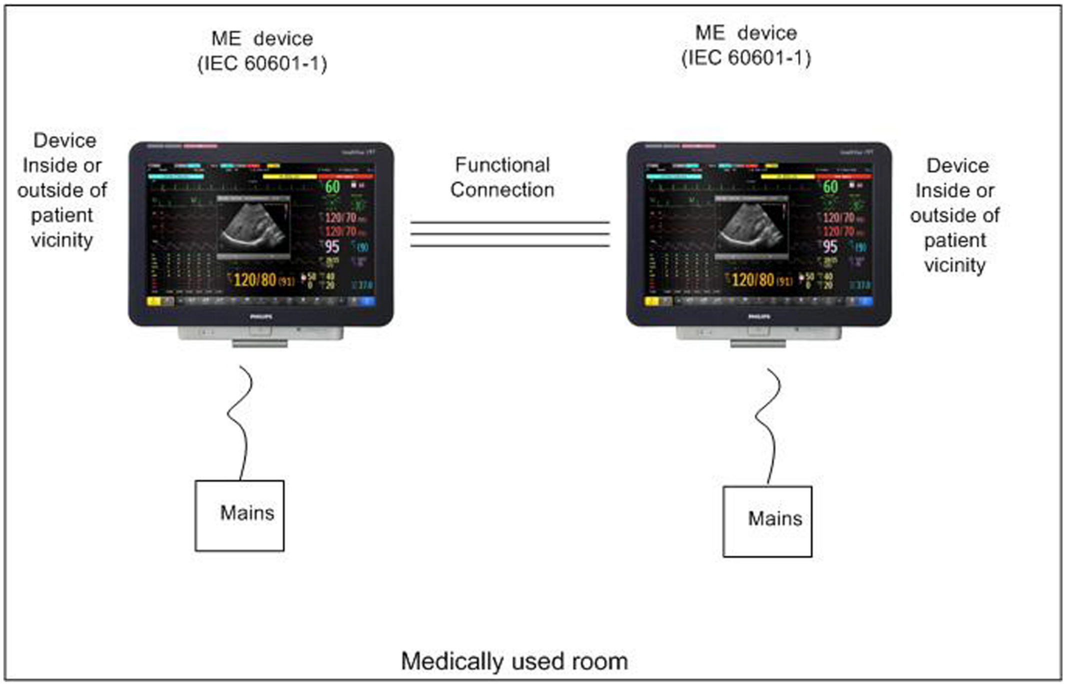

IT equipment
(IEC 60950-1)
Device **Inside** of patient vicinity
Separation device or other protective measure
Mains
Medically used room

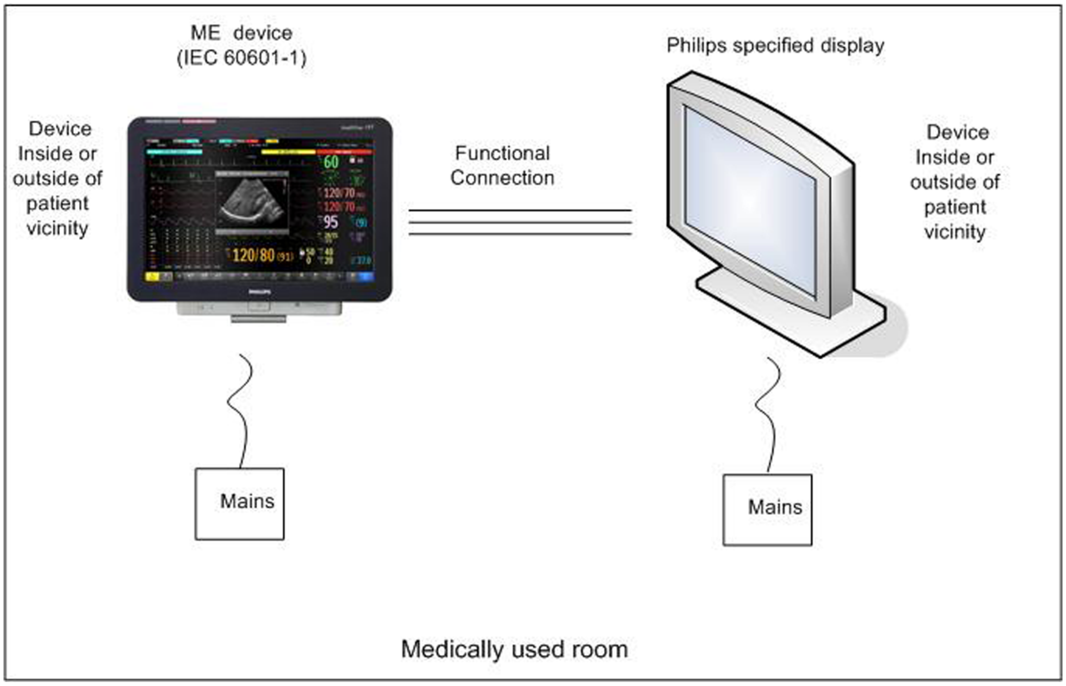
Case 1: Medical Device Combined with Medical Device

If you combine a medical device with another medical device (incl. Philips specified displays) to form a medical electrical system according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16, no additional protective measures are required. The medical electrical devices may be located in or outside the patient vicinity in a medically used room. This is valid as long as the medical devices are connected to separate mains outlets. No system test is required.

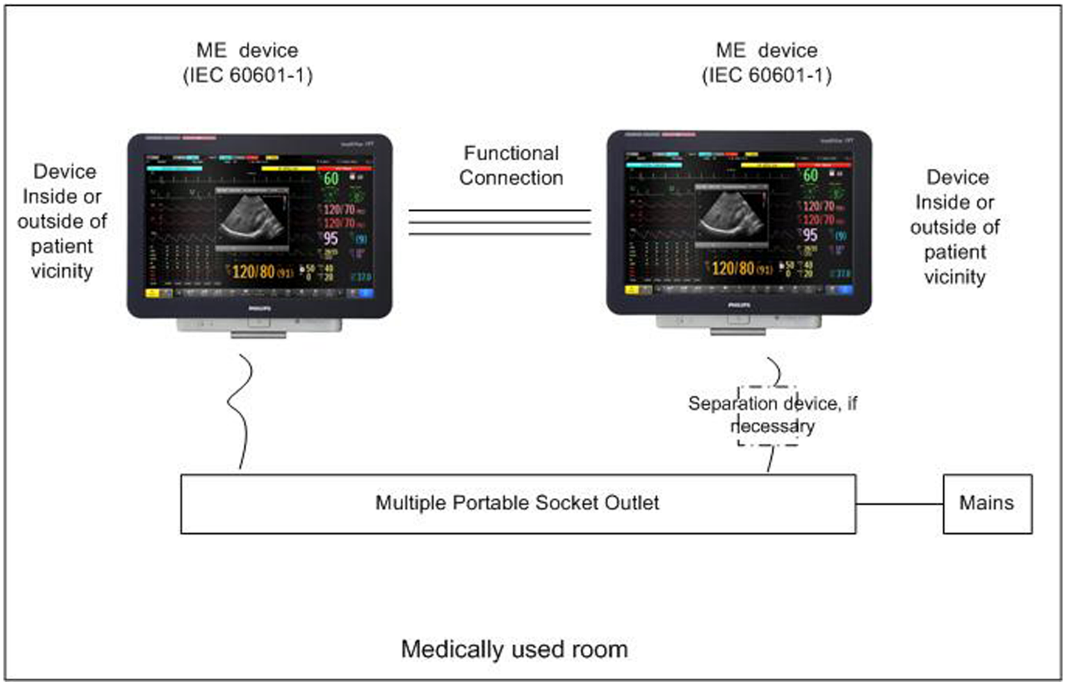
NOTE

The pictures below and in the following chapters show the MX800 monitor as an example. All cases apply to the MX400/450/500/550/600/700 monitors as well.


ME device
(IEC 60601-1)
ME device
(IEC 60601-1)
Device
Inside or
outside of
patient
vicinity
Functional
Connection
Device
Inside or
outside of
patient
vicinity
Mains
Mains
Medically used room

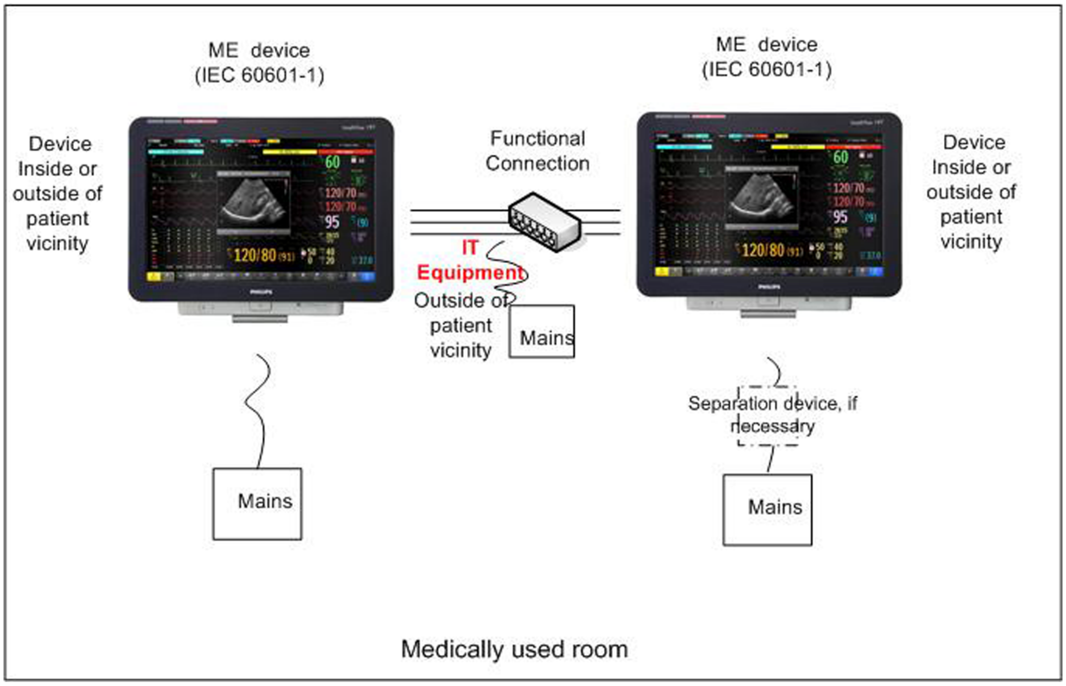

ME device
(IEC 60601-1)
Philips specified display
Device
Inside or
outside of
patient
vicinity
Functional
Connection
Device
Inside or
outside of
patient
vicinity
Mains
Mains
Medically used room

If the combined medical devices are connected to the same multiple portable socket outlet an enclosure leakage current test of the entire device combination on the multiple portable socket outlet is required to ensure that the resulting protective earth leakage current and equipment leakage current does not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Avoid using multiple portable socket outlets. The medical electrical devices may be located in or outside the patient vicinity in a medically used room. If the limits are exceeded, additional protective measures are required, e.g. a separation device or the connection of each device to separate mains.

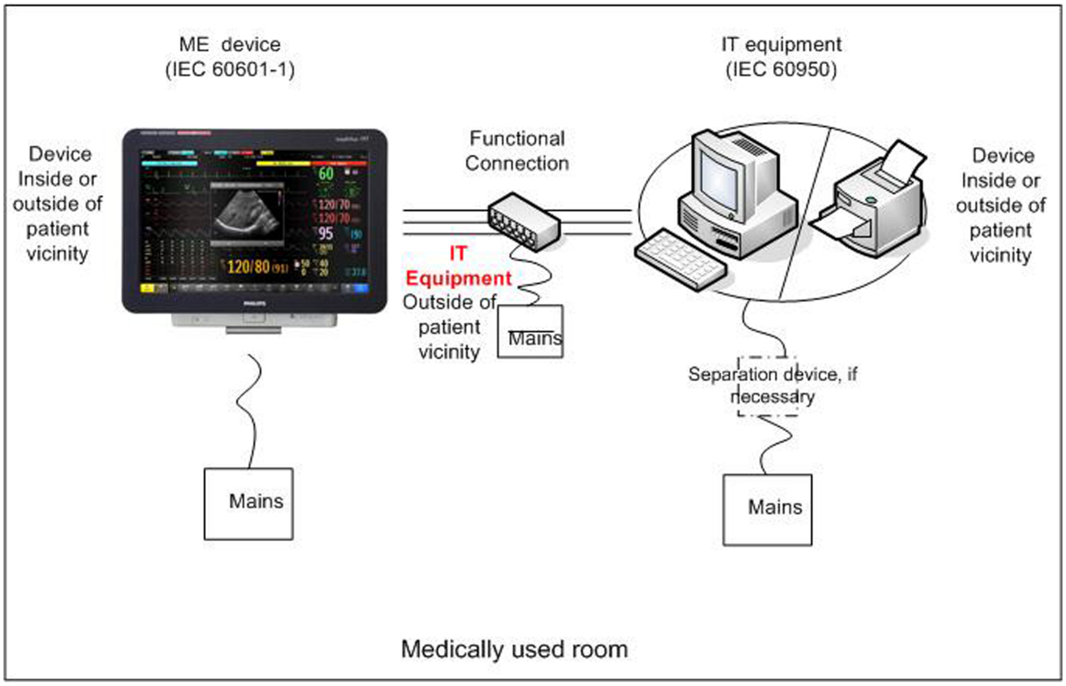

ME device
(IEC 60601-1)
ME device
(IEC 60601-1)
Device Inside or outside of patient vicinity
Functional Connection
Device Inside or outside of patient vicinity
Separation device, if necessary
Multiple Portable Socket Outlet
Mains
Medically used room

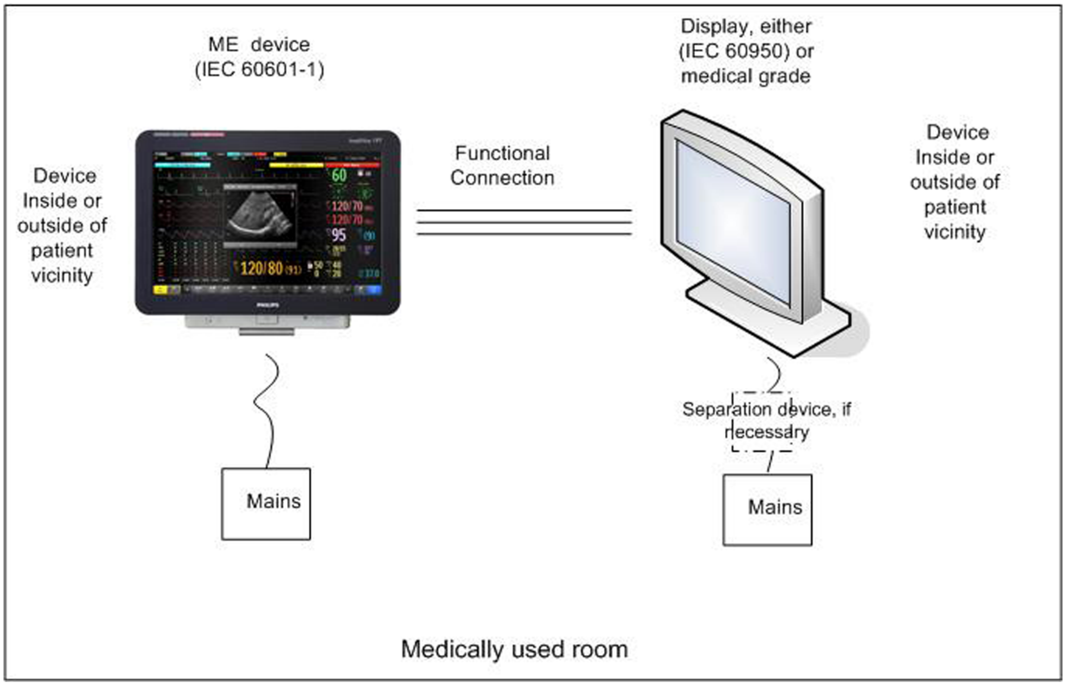
Case 2: Medical Device Combined with a Non-Medical Device

If you combine a medical device with a non-medical device to form a medical electrical system according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16, additional protective measures are required, e.g. usage of a separation device. The medical electrical devices or the IT equipment may be located in or outside the patient vicinity in a medically used room. After system installation incl. protective measures, a system test is required to ensure that the resulting equipment leakage current and applied part leakage current does not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.

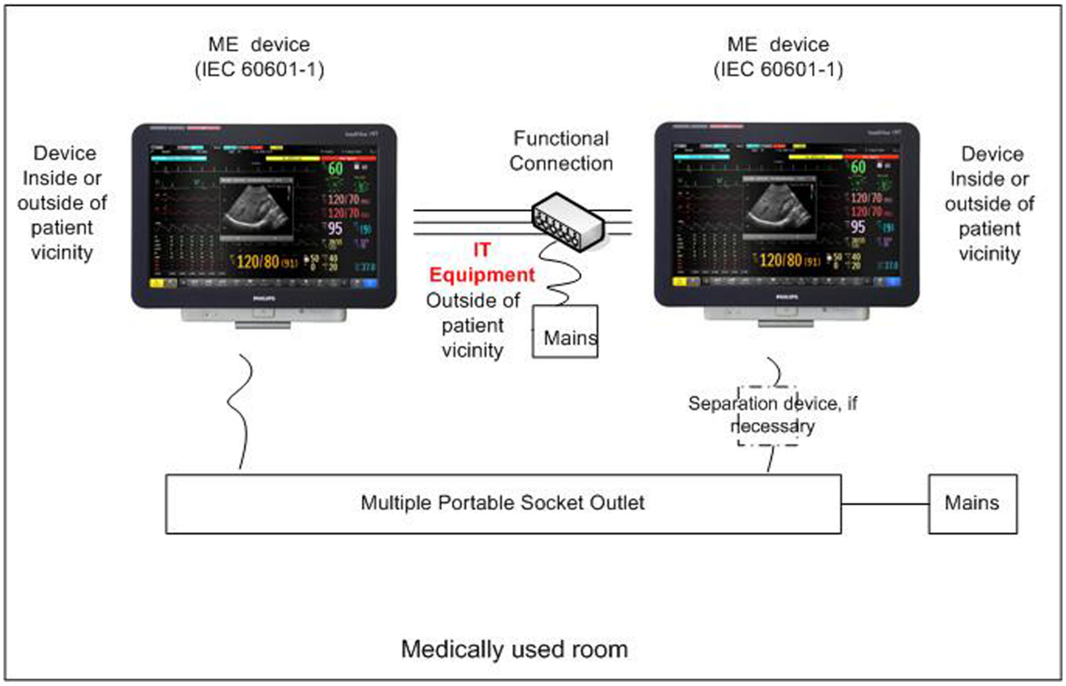

ME device
(IEC 60601-1)
ME device
(IEC 60601-1)
Device Inside or outside of patient vicinity
Functional Connection
IT Equipment
Outside of patient vicinity
Mains
Device Inside or outside of patient vicinity
Separation device, if necessary
Mains
Mains
Medically used room

For any IT equipment (IEC60950-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity, an equipment leakage current test is required.

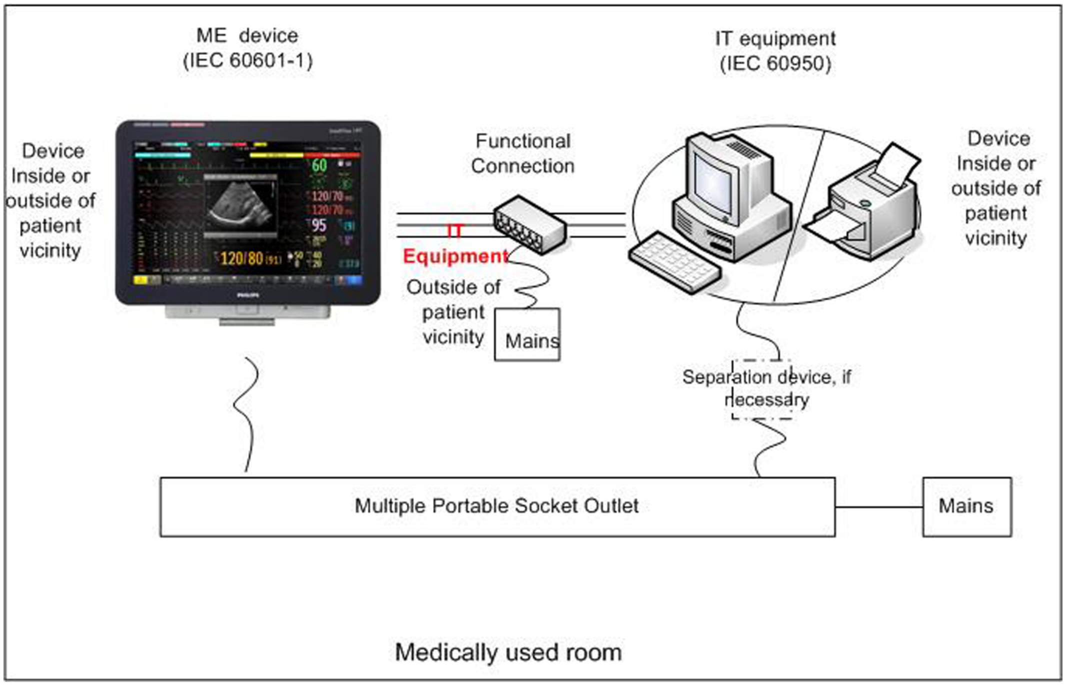

ME device
(IEC 60601-1)
IT equipment
(IEC 60950)
Device Inside or outside of patient vicinity
Functional Connection
Device Inside or outside of patient vicinity
IT Equipment
Outside of patient vicinity
Mains
Separation device, if necessary
Mains
Mains
Medically used room


ME device
(IEC 60601-1)
Display, either
(IEC 60950) or
medical grade
Functional Connection
Device Inside or outside of patient vicinity
Device Inside or outside of patient vicinity
Separation device, if necessary
Mains
Mains
Medically used room

If the combined devices forming the medical electrical system are connected to the same multiple portable socket outlet, ensure that the resulting protective earth leakage current **and** equipment leakage current do not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. The medical electrical devices or IT equipment may be located in or outside the patient vicinity in a medically used room. Avoid using multiple portable socket outlets. If the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 are exceeded, additional protective measures are required, e.g. a separation device or the connection of each device to separate mains.

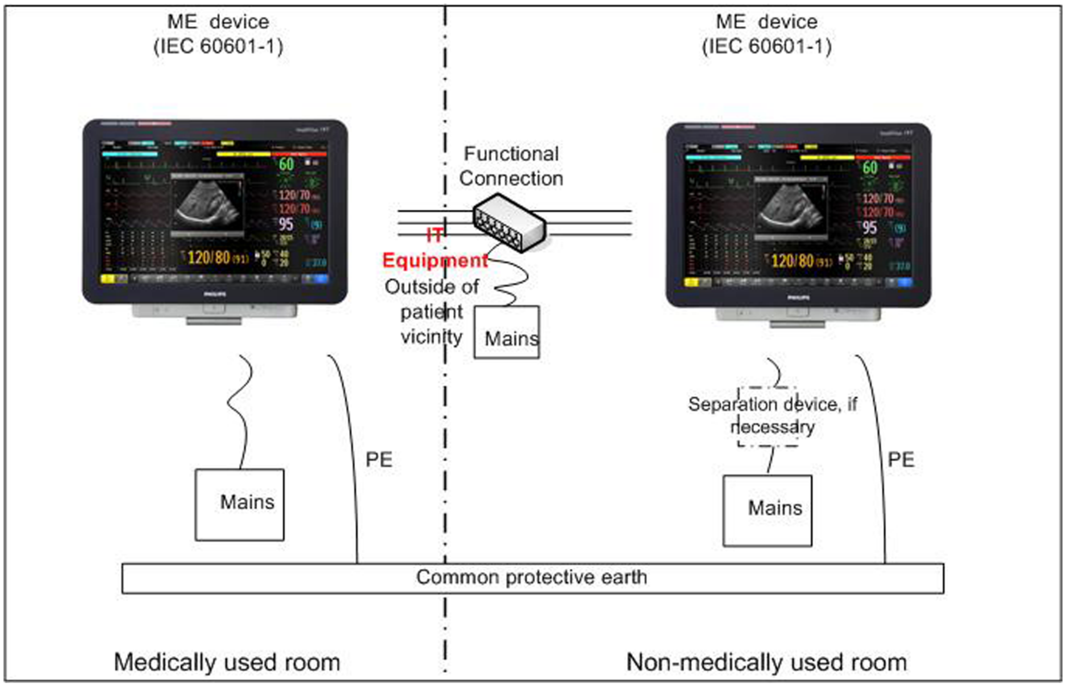

ME device
(IEC 60601-1)
ME device
(IEC 60601-1)
Device
Inside or
outside of
patient
vicinity
Functional
Connection
Device
Inside or
outside of
patient
vicinity
IT
Equipment
Outside of
patient
vicinity
Mains
Separation device, if
necessary
Multiple Portable Socket Outlet
Mains
Medically used room

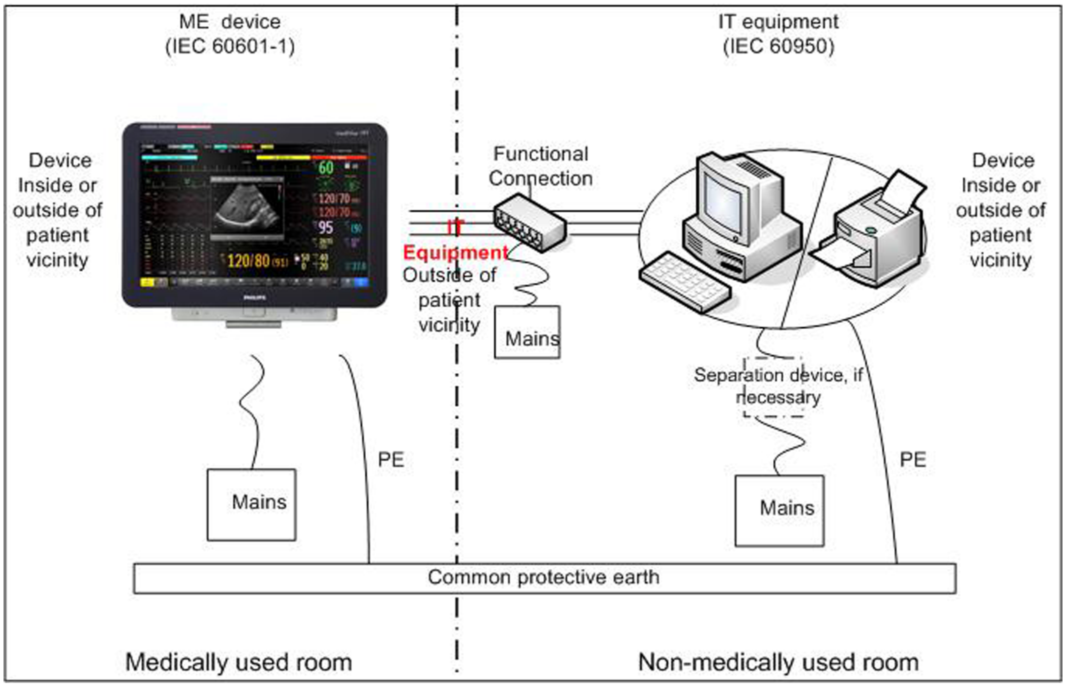
For any IT equipment (IEC60950-1) operated in patient vicinity ensure that the equipment leakage current does not exceed the limits described in IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Use a separation device to ensure compliance. After installation of IT equipment in patient vicinity, an equipment leakage current test is required.


ME device
(IEC 60601-1)
IT equipment
(IEC 60950)
Device
Inside or
outside of
patient
vicinity
Functional
Connection
Device
Inside or
outside of
patient
vicinity
IT
Equipment
Outside of
patient
vicinity
Mains
Separation device, if
necessary
Multiple Portable Socket Outlet
Mains
Medically used room

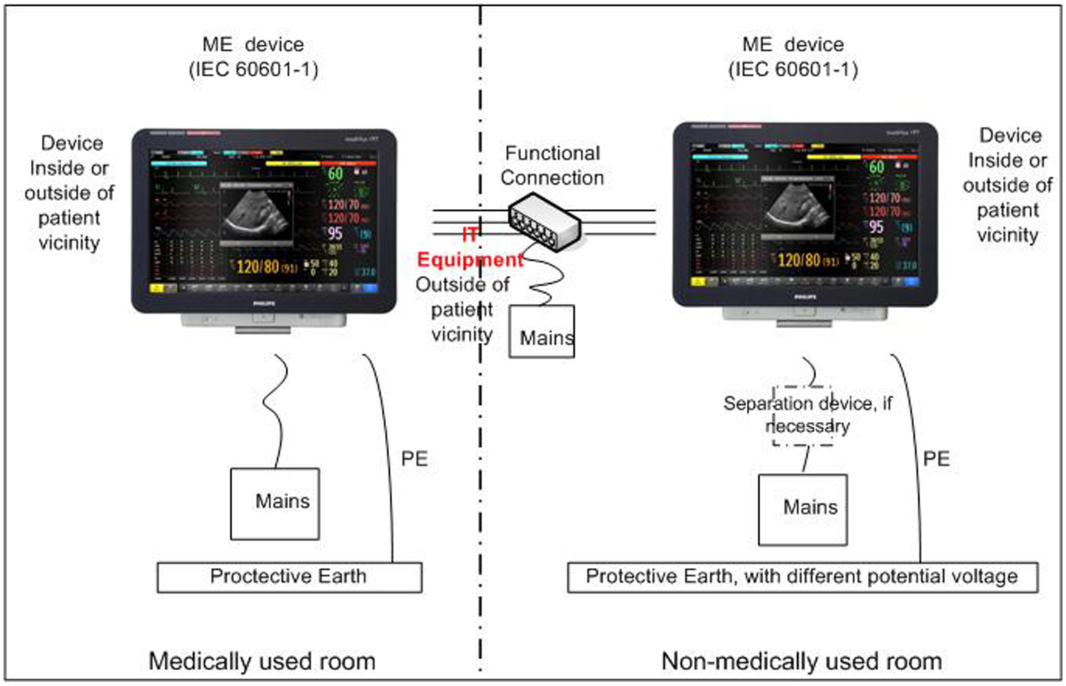
Case 3: Medical Device Combined with a Medical or Non-Medical Device with one Device in a Non-Medically-Used Room

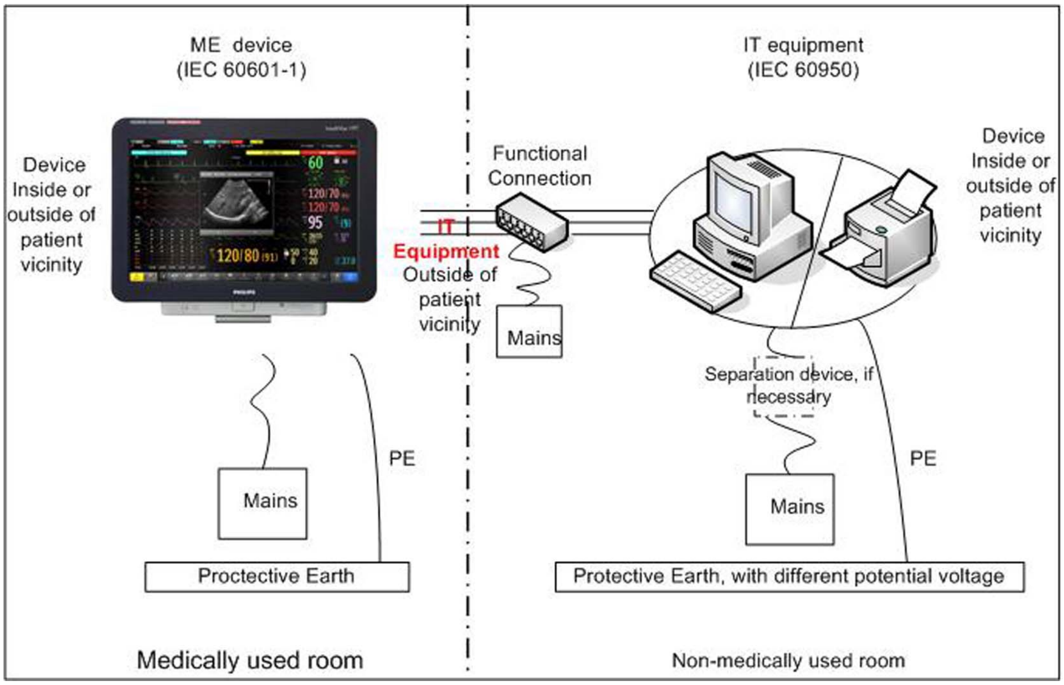
If you combine a medical device with a medical or non-medical device to form a medical electrical system according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 using a common protective earth connection and one of the devices is located in a non-medically used room, additional protective measures are required, e.g. usage of a separation device or additional protective earth connection. The medical electrical devices or IT equipment may be located in or outside the patient vicinity. After system installation incl. protective measures, a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.


ME device
(IEC 60601-1)
ME device
(IEC 60601-1)
Functional Connection
IT Equipment
Outside of patient vicinity
Mains
Mains
PE
Separation device, if necessary
Mains
PE
Common protective earth
Medically used room
Non-medically used room


ME device
(IEC 60601-1)
IT equipment
(IEC 60950)
Device Inside or outside of patient vicinity
Functional Connection
IT Equipment Outside of patient vicinity
Mains
Device Inside or outside of patient vicinity
Separation device, if necessary
PE
Mains
PE
Mains
Common protective earth
Medically used room
Non-medically used room

If you combine a medical device with a medical or non-medical device to form a medical electrical system according to IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 using two separate protective earth connections and one of the devices is located in a non-medically used room creating a potential voltage difference, additional protective measures are required, e.g. usage of a separation device or additional protective earth connection. The medical electrical devices or IT equipment may be located in or outside the patient vicinity. After system installation incl. protective measures, a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16.


ME device
(IEC 60601-1)
ME device
(IEC 60601-1)
Device Inside or outside of patient vicinity
Functional Connection
IT Equipment Outside of patient vicinity
Mains
Device Inside or outside of patient vicinity
Separation device, if necessary
PE
Mains
PE
Mains
Proctective Earth
Protective Earth, with different potential voltage
Medically used room
Non-medically used room


ME device
(IEC 60601-1)
IT equipment
(IEC 60950)
Device
Inside or
outside of
patient
vicinity
Functional
Connection
IT
Equipment
Outside of
patient
vicinity
Device
Inside or
outside of
patient
vicinity
Mains
Separation device, if
necessary
PE
Mains
PE
Mains
Proctective Earth
Protective Earth, with different potential voltage
Medically used room
Non-medically used room

System Test Procedure

If the medical electrical device has already been tested as a standalone device e.g. during factory safety testing, an equipment leakage current test must only be performed once the device is connected to another electrical device/system. If the medical electrical system has not been tested as a standalone device, the device has to be tested as a standalone device (without connection to the system) and as part of the system (with connection to the system).

Connect the detachable power cord of the device under test to the safety analyzer's test mains port. Connect the enclosure test lead of the safety analyzer to the enclosure of the device under test as described in the "Equipment Leakage Test" section . Refer to the documentation that accompanies the safety analyzer for further details on how to set up the test.

Test	Expected test results
Equipment Leakage Current Test (Normal Condition)	Sys1 <= 100µA
Equipment Leakage Current Test (Single Fault Condition)	Sys2 <= 300µA

After the testing of the device as a standalone device and as part of the system, check that the resulting values (without connection and with connection to the system) do not differ by more than +/- 10% from each other.

If the devices in the medical electrical system are connected to a multiple portable socket outlet the resulting protective earth leakage current needs to be determined. All system components must be connected to the multiple portable socket outlet and be switched on during this measurement.

Test	Expected test results
Protective Earth Leakage Current of Multiple Socket Outlets	Sys3 <= 300µA

Refer to the documentation that accompanies the safety analyzer for further details on how to set up the test.

Preventive Maintenance Procedures

Noninvasive Blood Pressure Measurement Calibration

Carry out the noninvasive blood pressure measurement performance tests at least every two years , or as specified by local laws (whichever comes first).

Microstream CO2 Calibration

Carry out the Microstream CO_2 calibration once a year or after 4000 hours of continuous use and following any instrument repairs or the replacement of any instrument parts.

Performance Assurance Tests

Some of the following test procedures must be performed in service mode. To enter service mode select **Operating Modes** in the main menu. Then select **Service Mode** and enter the password.

If required, open the screen menu in the monitor info line at the top of the screen and select **Service** to access the service screen. This is required particularly for Anesthetic Gas Module testing procedures.

Basic Performance Assurance Test

This section describes the basic performance test procedure. Please refer to the section for detailed information on when which test procedure is required.

Procedure:

Power on the monitoring system and go into demo mode. Check that each connected parameter (module, MMS, Gas Analyzer, IntelliBridge connected device) displays values.

Full Performance Assurance Test

The following sections describe the full performance testing procedures i.e. detailed testing of each parameter with a patient simulator or specified tools. Please refer to the section for information on when which testing procedure is required.

ECG/Resp Performance Test

This test checks the performance of the ECG and respiration measurements.

Tools required: Patient simulator.

ECG Performance

1. Connect the patient simulator to the ECG/Resp connector on the MMS/IntelliVue X2.
2. Configure the patient simulator as follows:
   - ECG sinus rhythm.
   - HR = 100 bpm or 120 bpm (depending on your patient simulator).
3. Check the displayed ECG wave and HR value against the simulator configuration.
4. The value should be 100bpm or 120 bpm+/- 2 bpm.

Respiration Performance

1 Change the Patient Simulator configuration to:
  – Base impedance line 1500 Ohm.
  – Delta impedance 0.5 Ohm.
  – Respiration rate 40 rpm or 45 rpm.

2 The value should be 40 rpm +/- 2 rpm or 45 rpm +/- 2 rpm.

Test	Expected test results
ECG Performance Test	100 bpm +/- 2 bpm or 120 bpm +/- 2 bpm
Respiration Performance Test	40 rpm +/- 2 rpm or 45 rpm +/- 2 rpm

ECG Out Performance Test

This test checks the performance of ECG synchronization between the monitor and a defibrillator. It only needs to be performed when this feature is in use as a protocol at the customer site.

Tools required:

- Defibrillator with ECG Input.
- Patient simulator.

1 Connect the patient simulator to the ECG connector of the MMS and the defibrillator to the ECG Output on the monitor with the ECG Sync cable.

2 Set the patient simulator to the following configuration:
  – HR = 100 bpm or 120 bpm (depending on your patient simulator).
  – ECG sinus rhythm.

3 Switch the defibrillator to simulation mode.

4 Check that the ECG signal is displayed.

Test	Expected test results
ECG Out Performance Test	ECG signal is displayed (pass/fail)

SpO2 Performance Test

This test checks the performance of the SpO_2 measurement.

Procedure for Philips FAST SpO_2 Technology:

Tools required: none

1 Connect an adult SpO_2 transducer to the SpO_2 connector.

2 Measure the SpO_2 value on your finger (this assumes that you are healthy).

3 The value should be between 95% and 100%.

Test	Expected test results
SpO_2 Performance Test	95% and 100%

Procedure for Nellcor OxiMax SpO_2 Technology:

Nellcor recommends that the functionality of this parameter be verified using the SRC-MAX.

A possible performance assurance check requiring no tools would be:

1. Connect an adult SpO_2 transducer to the SpO_2 connector.
2. Measure the SpO_2 value on your finger (this assumes that you are healthy).
3. The value should be between 95% and 100%.

Test	Expected test results
SpO_2 Performance Test	95% and 100%

Procedure for Masimo SET SpO_2 Technology:

The end user may verify SpO_2 performance via commercially available SpO_2 simulators specifically designed to work with Masimo Pulse Oximeter technology. Optical simulators are recommended as they use the patient cable and sensor as part of the test setup. Additionally, a test that includes placing the sensor on a healthy subject and confirming the device reads a normal saturation and pulse rate and displays a clean pleth waveform (while the subject is still) may further increase the confidence that the device is functioning properly.

Measurement Validation

NOTE

A functional tester cannot be used to assess the accuracy of a pulse oximeter monitor or sensor. However, it can be used to demonstrate that a particular pulse oximeter monitor reproduces a calibration curve that has been independently demonstrated to fulfill a particular accuracy specification.

Philips FAST SpO_2 Technology

The SpO_2 accuracy has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. In a controlled desaturation study, healthy adult volunteers with saturation levels between 70% and 100% SaO_2 were studied. The population characteristics for those studies were:

- about 50% female and 50% male subjects
- age range: 19 to 39
- skin tone: from light to dark brown

Pulse rate accuracy has been validated with an electronic pulse simulator.

Nellcor OxiMax Technology

Accuracy specifications are based on controlled hypoxia studies with healthy non-smoking adult volunteers over the specified saturation SpO2 range(s). Pulse oximeter SpO2 readings were compared to SaO2 values of drawn blood samples measured by hemoximetry. All accuracies are expressed as ± "X" digits. Pulse oximeter equipment measurements are statistically distributed; about two-thirds of pulse oximeter measurements can be expected to fall in this accuracy (ARMS) range. Because scatter and bias of pulse oximeter SpO2 and blood SaO2 comparisons commonly increase as the saturation decreases, and accuracy specifications are calculated from data spanning the stated range, different accuracy values may result when describing partially overlapping ranges.

Subjects used to validate SpO2 measurement accuracies were healthy and recruited from the local population. Comprised of both men and women, subjects spanned a range of skin pigmentations and ranged in age from 18-50 years old.

Oxygen saturation accuracy can be affected by certain environmental, equipment, and patient physiologic conditions (as discussed in the Instructions for Use for the monitor) that influence readings of SpO2, SaO2, or both. Accordingly, observations of clinical accuracy may not achieve the same levels as those obtained under controlled laboratory conditions.

Pulse rate accuracy has been validated with an electronic pulse simulator.

Masimo SET SpO2 Technology

The SpO2 accuracy (except for LNOP Blue sensors) has been validated in human studies against arterial blood sample reference measured with a CO-oximeter. In a controlled desaturation study, healthy adult volunteers with saturation levels between 70% and 100% SpO2 were studied.

The population characteristics for those studies were:

- healthy female subjects: 22 to 39 years of age; light to dark skin pigmentation
- healthy male subjects: 19 to 37 years of age; light to dark skin pigmentation

The LNOP Blue SpO2 accuracy has been validated in human blood studies on neonatal, infant and pediatric patients with congenital cyanotic cardiac lesions in the range of 60%-100% SpO2 against a laboratory CO-oximeter.

The population characteristics for those studies were:

- female patients: 5 days to 20 months of age; light and dark skin pigmentation
- male patients: 1 day to 13 months of age; light and dark skin pigmentation

Pulse rate accuracy has been validated with an electronic pulse simulator or ECG as reference.

For further information please refer to the Instructions for Use of the Device and Accessories.

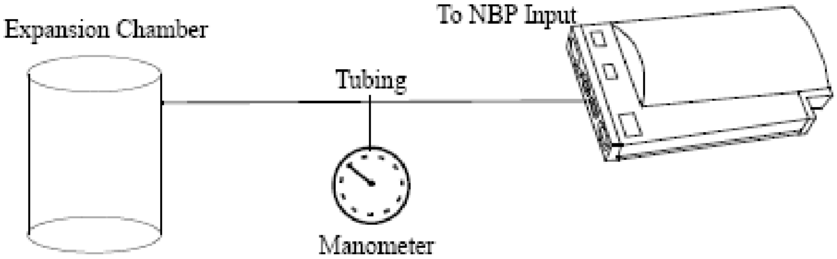
NBP PerformanceTest

This section describes NBP test procedures.The monitor must be in service mode and the screen “Service A” must be selected to perform these tests. The NBP Performance Test consists of:

- NBP Accuracy Test
- NBP Leakage Test
- NBP Linearity Test
- Valve Test

NBP Accuracy Test and Calibration

This test checks the performance of the non-invasive blood pressure measurement. Connect the equipment as shown:



Tools required:

- Reference manometer (includes hand pump and valve), accuracy +/-0.8mmHg.
- Expansion chamber (volume 250 ml +/- 10%)
- Appropriate tubing.

In service mode, the systolic and diastolic readings indicate the noise of NBP channels 1 and 2 respectively. When static pressure is applied, the reading in NBP channel 1 should be below 50. The value in parentheses indicates the actual pressure applied to the system.

1. Connect the manometer and the pump with tubing to the NBP connector on the MMS and to the expansion chamber.
2. In service mode, select the **Setup NBP** menu.
3. Select **Close Valves**: **On**
4. Raise the pressure to 280 mmHg with the manometer pump.
5. Wait 10 seconds for the measurement to stabilize.
6. Compare the manometer values with the displayed values.
7. Document the value displayed by the monitor (**x1**).
8. If the difference between the manometer and displayed values is greater than 3 mmHg or if the NBP pump assembly has been exchanged, calibrate the MMS. If not, proceed to the leakage test.
9. To calibrate the MMS, select **Close Valves off** then **Calibrate NBP** and wait for the instrument to pump up the expansion chamber.Wait a few seconds after pumping stops until **EnterPrVal** is highlighted and then move the cursor to the value shown on the manometer. If one of the following prompt messages appears during this step, check whether there is leakage in the setup:
   – NBP unable to calibrate–cannot adjust pressure
   – NBP unable to calibrate–unstable signal
10. Press **Confirm**.

If the INOP NBP Equipment Malfunction message occurs in monitoring mode, go back to service mode and repeat the calibration procedure.

NBP Leakage Test

The NBP leakage test checks the integrity of the system and of the valve. It is required once every two years and when you repair the MMS or X2 or replace parts.

1. If you have calibrated, repeat steps 2 to 6 from the accuracy test procedure so that you have 280 mmHg pressure on the expansion chamber.
2. Watch the pressure value for 60 seconds.

3 Calculate and document the leakage test value (**x2**).
x2 = P1 - P2
where P1 is the pressure at the beginning of the leakage test and P2 is the pressure displayed after 60 seconds.
The leakage test value should be less than 6 mmHg.

NOTE

The leakage test value of 6 mmHg applies for an expansion chamber of 250ml. When using a different size of expansion chamber, the expected test result needs to be adapted accordingly. E.g for an expansion chamber of 500ml, the leakage test value should be less than 3 mmHg. All other NBP performance tests are independent of the expansion chamber size.

NBP Linearity Test

1. Reduce the manometer pressure to 150 mmHg.
2. Wait 10 seconds for the measurement to stabilize.
3. After these 10 seconds, compare the manometer value with the displayed value.
4. Document the value displayed by the monitor (**x3**)
5. If the difference is greater than 3 mmHg, calibrate the MMS or X2 (see steps 9 to 10 in the accuracy test procedure).

Valve Test

1. Raise the pressure again to 280 mmHg.
2. Select **Close valves**: **Off**.
3. Wait five seconds and then document the value displayed. The value should be less than 10 mmHg.
4. Document the value displayed by the monitor (x4).

Test	Expected test results
Accuracy test	x1 = 280 ± 3mmHg Difference ≤ 3mmHg
Leakage test	x2 = leakage test value x2 < 6 mmHg (with 250ml expansion chamber)
Linearity test	x3 = 150 ± 3mmHg Difference ≤ 3mmHg
Valve Test	x4 = value < 10 mmHg

Invasive Pressure Performance Test

This test checks the performance of the invasive pressure measurement.

Tools required: Patient simulator.

1. Connect the patient simulator to the pressure connector.
2. Set the patient simulator to 0 pressure.
3. Make a zero calibration.

4 Configure the patient simulator as P(static) = 200 mmHg.

5 Wait for the display.

6 The value should be 200 mmHg ± 5 mmHg. If the value is outside these tolerances, calibrate the Invasive Pressure measurement. If the measurement was calibrated with a dedicated reusable catheter, check the calibration together with this catheter.

Test	Expected test results
Invasive Pressure Performance Test	200 mmHg ± 5 mmHg

Temperature Performance Test

This test checks the performance of the temperature measurement.

Tools required: Patient simulator (with 0.1°C or 0.2°F tolerance).

1 Connect the patient simulator to the temperature connector.

2 Configure the patient simulator to 40°C or 100°F.

3 The value should be 40°C ± 0.2°C or 100°F ± 0.4°F.

Test	Expected test results
Temperature Performance Test	40°C ± 0.2°C or 100°F ± 0.4°F

M3014A Capnography Extension Performance Tests

The procedures below describe the mainstream and sidestream CO2 performance tests for the M3014A Capnography Extension.

Mainstream CO2 Accuracy Check

Tools Required:

- three airway adapters
- Verification Gas M2506A
- Gas cylinder regulator M2505A

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

Procedure:

1 Attach the M2501A CO_2 sensor to the patient monitor. Attach an airway adapter to the sensor. Make sure that the sensor is disconnected from the patient circuit.

2 Switch on the patient monitor.

3 Enter the monitor's Service Mode.

4 Using the sensor status provided in the M2501A Serial protocol, wait for the M2501A sensor to warm up to its operating temperature.

5 The default setting for gas temperature is 22°C. If the gas temperature is significantly above or below this value, correct the gas temperature setting.

6 Zero the sensor on the airway adapter being used in this test. Ensure Zero Gas is set to Room Air

7 Attach a regulated flowing gas mixture of 5% CO2, balance N2 to the airway adapter.

8 Set the gas correction to off.

9 Allow a few seconds for the gas mixture to stabilize and observe the CO2 value. The expected value is 5% of the ambient pressure ±2mmHg

NOTE

Make sure that you follow the above steps correctly. If the sensor fails this check it must be exchanged. The sensor cannot be calibrated.

Example for an expected test result:
The expected test result for an altitude of 0 m (sea level) at approximately 760 mmHg ambient pressure is:

Test	Expected test results (x1)	Acceptance Range
Mainstream CO2 Accuracy Test	5% of 760 mmHg pressure ±2mmHg	36 mmHg - 40 mmHg

NOTE

The expected test results will differ depending on the conditions (i.e. altitude or ambient pressure).

Sidestream CO2 Accuracy Check

Tools Required:

- Cal gas flow regulator M2267A
- Cal tube 13907A
- Verification Gas M2506A
- Straight Sample Line M2776A

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

Procedure:

1 Attach the M2741A CO2 sensor to the patient monitor. Attach the sample line and the cal tube to the sensor. Make sure that the sensor is disconnected from the patient circuit.

2 Switch on the patient monitor.

3 Enter the monitor's Service Mode.

4 Using the sensor status provided in the M2741A Serial protocol, wait for the M2741A sensor to warm up to its operating temperature.

5 Zero the sensor. Ensure Zero Gas is set to Room Air

6 Attach a regulated flowing gas mixture of 5% CO2, balance N2 to the cal tube.

7 Set the gas correction to off.

8 Allow a few seconds for the gas mixture to stabilize and observe the CO2 value. The expected value is 5% of the ambient pressure ±2mmHg

NOTE

Make sure that you follow the above steps correctly. If the sensor fails this check it must be exchanged. The sensor cannot be calibrated

Example for an expected test result:
The expected test result for an altitude of 0 m (sea level) at approximately 760 mmHg ambient pressure is:

Test	Expected test results (x2)	Acceptance Range
Sidestream CO2 Accuracy Test	5% of 760 mmHg pressure ±2mmHg	36 mmHg - 40 mmHg

NOTE

The expected test results will differ depending on the conditions (i.e. altitude or ambient pressure).

Sidestream CO2 Flow Check

Check the flow rate in the Sidestream CO2 extension as follows:

1. Connect the flowmeter to the sample line
2. Check on the flowmeter the flow that the Sidestream CO_2 extension pump draws. It should be 50 ml/min ± 10 ml/min. If the value is not within tolerance check your setup again and perform another flow check. If it fails again, the sensor must be replaced. The sensor cannot be calibrated.

Example for an expected test result:
The expected test result for an altitude of 0 m (sea level) at approximately 760 mmHg ambient pressure is:

Test	Expected test results (x3)	Acceptance Range
Sidestream CO2 Flow Check	50 ml/min ±10 ml/min	40 ml/min - 60 ml/min

NOTE

The expected test results will differ depending on the conditions (i.e. altitude or ambient pressure).

Microstream CO2 Performance Test

Allow five seconds between individual service procedures to ensure stable equipment conditions. When certain monitor procedures are running, service procedures are not possible and trying to start them will result in a message **Service Operation Failed** in the monitor’s status line. Wait until the monitor completes the current operation, then restart the service procedure.

This test checks the performance of the Microstream CO2 measurement. The Microstream CO2 measurement can either be integrated into the IntelliVue MP5 monitor or, for other IntelliVue monitors, into the M3015A/B MMS Extensions. The Microstream CO2 performance test is required once per year or after 4000 hours of continuous use and when the instrument is repaired or when parts are replaced.

This test uses calibration equipment that you can order (see the *Parts* section for the part number). The procedure is summarized in the following steps. Refer to the documentation accompanying the equipment for detailed instructions.

Tools Required:

- Standard tools, such as screwdriver, tweezers
- Electronic flowmeter, M1026-60144 or Mass Flowmeter 453564178121
- Digital Barometer ±2mbar or better
- Gas calibration equipment:

- Cal 1 gas 15210-64010 (5% CO_2)
- Cal 2 gas 15210-64020 (10% CO_2)
- Cal gas flow regulator M2267A
- Cal tube 13907A
- Calibration Line M3015-47301
- Leakage Test Kit M1013-64002 (451261014851) (only required for leakage test without M1026-60144 Flowmeter)
- Flexible Connecting Tube

You also need a local barometric pressure rating received from a reliable local source (airport, regional weather station or hospital weather station) which is located at the same altitude as the hospital.

The CO2 calibration for the Microstream extension consists of the following steps:

- Leakage check, **either** with M1026-60144 Flowmeter **or** with 453564178121 Mass Flowmeter*
- Barometric pressure check and calibration, if required.*
- Flow check and calibration, if required
- Noise check
- CO2 Cal check and calibration, if required
- CO2 Cal verification

Perform all checks in the same session.

* Not applicable for all HW Revisions. See individual test sections for details.

NOTE

The M3015A/B HW Rev C is indicated as HW Rev. Q.xx.xx in the IntelliVue Revision Screen.

Leakage Check with M1026-60144 Flowmeter (only for M3015A with HW Rev. A and B and Firmware Revision < P.01.32)

The leakage check consists of checking the tubing between:

- the pump outlet and the mCO_2 outlet and
- the pump inlet and calibration line inlet.

Check the user's guide of the flowmeter for details on how to make a correct flow reading.

Part 1

1 Go into service mode and select **Setup CO2** menu.

2 Connect a calibration line to the Microstream CO_2 input to start the pump running.

3 Check the ambient pressure and the cell pressure shown in the monitor's status line. The cell pressure should be approximately 20 mmHg lower than ambient pressure. (This test is only to check that the pump starts and is running, which is also indicated by the noise generated by the running pump.)

4 Connect the flowmeter outlet to the calibration line inlet using a flexible connecting tube.

5 Block the mCO_2 outlet using your fingertip and observe the flowmeter display. The value on the flowmeter (**x1**) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. If the value is within the tolerance limits, continue with part 2 of the leakage check.

6 If the value is outside the tolerance limits, there is a leakage between the pump outlet and the mCO_2 outlet.

7 Open the MMS Extension or MP5 and check the tubing connections at the pump outlet and the extension gas outlet. If the connections are good, then there is a leakage in the tubing and you must exchange the MMS Extension or the mCO_2 Assembly of the MP5 respectively.

Part 2

1 Disconnect the flowmeter from the Part 1 setup and connect the flowmeter inlet to the M3015A gas outlet or the MP5 mCO_2 gas outlet.

2 Leave the calibration line connected to the M3015A inlet or the MP5 mCO_2 inlet..

3 Block the inlet of the calibration line using your fingertip and observe the flowmeter display. The value on the flowmeter (**x2**) should decrease to between 0 and 4 ml/min, accompanied by an audible increase in pump noise. The cell pressure shown in the status line on the display should decrease to between 300 and 500 mmHg. Do not block the inlet for longer than 25 seconds as this will lead to an “Occlusion” INOP. If the value is within the tolerance limits, there are no leakages and the leakage check is completed; proceed to the pump check.

4 If the value is not within the tolerance limits, there is a leakage between the calibration line inlet and the pump inlet.

5 Check the calibration line connections and open the M3015A or MP5 to check the tubing connections at the pump inlet and the M3015A or MP5 mCO_2 gas inlet. If the connections are good, try replacing the calibration line and repeating the leakage check. If the situation remains, there is a leakage in the tubing and the M3015A or the mCO_2 assembly of the MP5 must be exchanged.

Test	Expected test results
Leakage Check Parts 1 and 2	**x1** = value of part 1 leakage check on flowmeter (**x1**< 4.0 ml/min) **x2** = value of part 2 leakage check on flowmeter (**x2**< 4.0 ml/min)

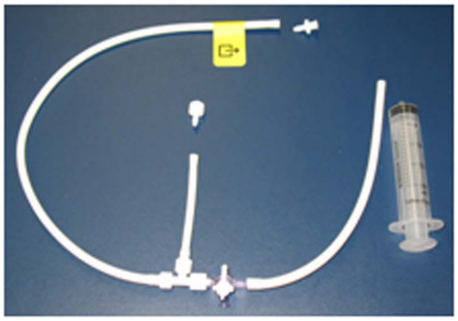
Leakage Check for M3015B and M3015A with HW Rev C or M3015A with HW Rev. A/B without M1026-60144 Flowmeter

Preparation of Leakage Test Kit:

Remove two Luer connectors from the Leakage Test Kit, as shown in the following picture.

NOTE

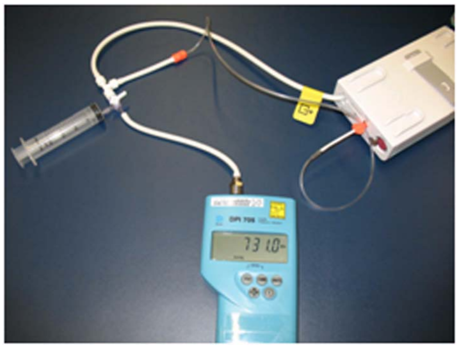
These Luer connectors are not required for the actual Leakage Check. However, you should keep them, as they are required for other tests (e.g. for the kit leak test as documented later in this section).



Test Setup:

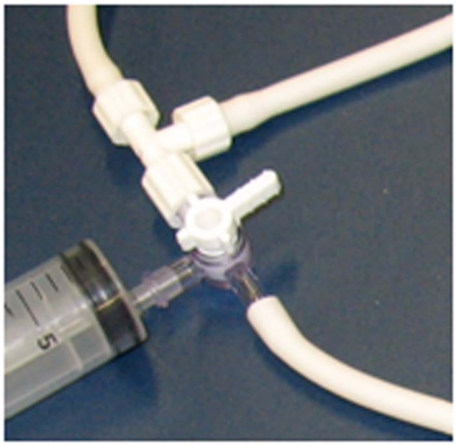
1 Connect the Calibration Line (M3015-47301) to the inlet of the M8105A/M3015A/B (the M8105A/M3015A/B must be switched off, either by disconnecting from the host monitor or by switching off the monitor).

2 Connect the leakage test tubing to the outlet of the M8105A/M3015A/B, to the digital barometer, to the calibration line, and the (empty) syringe as shown below. Make sure all connections have a tight fit!



Test Procedure:

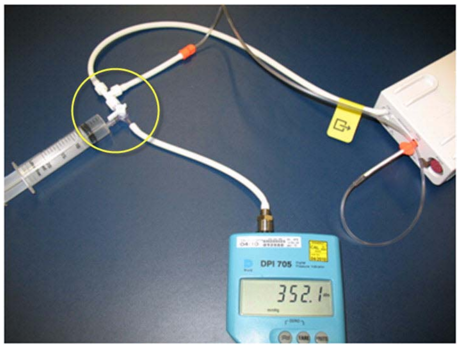
1 Open the 3-way stopcock for all three limbs.



2 Switch on the digital barometer (the digital barometer should now display the actual ambient pressure).

3 Now slowly draw at the syringe, as if filling the syringe, until the pressure (as displayed on the digital barometer) drops to approximately 350 mbar below ambient pressure.Then close the line to the syringe at the 3-way stopcock to syringe (circled in picture below).

4 Let the reading on the digital barometer stabilize for a moment and then perform the leakage check: for 30 seconds the change of the pressure reading should be less than 20 mbar.



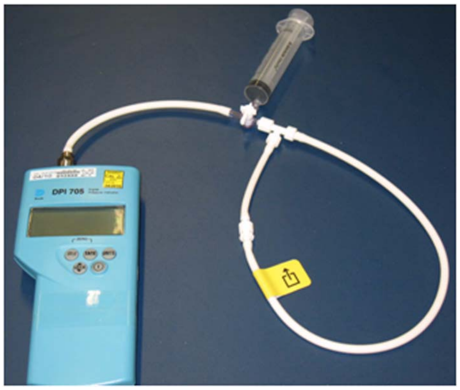
5 If the leakage test is NOT passed, check all connections once more and repeat the test.

Test	Expected test results
Leakage Check	Reading on the digital barometer change is less than 20 mbar for 30 seconds (pass/fail)

NOTE

To ensure the integrity of the Leakage Test Kit (M1013-64002, 451261014851) the following Kit Leak Test Procedure must be performed:

a. Form a loop with the leakage test kit as shown in the picture below.



b. Connect the syringe to the 3-way stopcock and the digital barometer to the open tubing.

c. Draw at the syringe until the digital barometer shows approximately 350 mbar below ambient pressure.

d. Close the 3-way stopcock to the syringe and wait 5 - 10 seconds. In this time, the overall pressure should stabilize.

e. After 1 minute, check the pressure. The pressure should not increase more than 8 mbar in 1 minute for the test to pass.

f. If this test fails, exchange the leakage test kit.

Barometric Pressure Check and Calibration

NOTE

The M3015A with HW Rev C and the M3015B do not require calibration of the barometric pressure. Therefore you will not be able to activate a barometric pressure calibration. If you are using a HW Rev C M3015A or M3015B, perform the barometric pressure check as described below, making sure that only a sample line is connected to the MMS Extension. If the pressure check fails, the M3015A/B needs to be exchanged.

Check the barometric pressure value in the M3015A/B MMS Extension or the MP5 as follows:

1 Go into service mode and select **Setup CO_2** menu.

2 Connect a calibration line to the Microstream CO_2 input. This activates the pump in the M3015A/B MMS Extension or the MP5.

3 The status line at the bottom of the screen displays “CO_2 pressure reading (ambient/cell) xxx/yyy” where xxx is the ambient pressure and yyy is the measured cell pressure. Check whether the ambient pressure value (**x3**) matches (within the acceptable tolerance of ±12mm Hg) the reference value you have received. If so, proceed to the leakage check.
If the value is not correct, calibrate as follows.

a. Select **CO_2** then select **Barom.Press** to activate a table of values.

b. Select the value in the table which matches the reference value received from a reliable local source (airport, regional weather station or hospital weather station). (The values are displayed with a resolution of 2 mmHg up to 500 mmHg and a resolution of 1 mmHg from 500 mmHg to 825 mmHg.) Note: the selected value must be within ±10% of the current measured ambient pressure, otherwise an error message will occur at restarting the monitor.

c. Confirm the barometric pressure setting.

d. Check that the ambient pressure displayed in the status line at the bottom of the screen is the same as the value which you selected from the list in step b.

Test	**Expected test results**
Barometric Pressure Check	**x3** = difference between the reference pressure and the measured ambient pressure displayed on the monitor (**x3**<12 mmHg)

Flow Rate Check and Calibration

Check the flow rate in the M3015A/B MMS Extension or the MP5 as follows:

1 Connect the calibration line to the mCO_2 inlet and the flowmeter outlet to the calibration line.

2 Check on the flowmeter the flow that the M3015A/B MMS Extension or MP5 mCO2 pump draws (**x5**). It should be 50 +15/-7.5 ml/min. If the value is within tolerance, proceed to the CO_2 Gas calibration check.
If the value is not within tolerance, calibrate as follows.

a. Adjust the flow in the instrument by selecting **Increase Flow** or **Decrease Flow** until it is as close as possible to 50 ml per minute as indicated on the flowmeter gauge.

b. When you are satisfied that the flow is set as close as possible to 50 ml per minute, select **Store Flow** and confirm the setting. If you do not store the adjusted flow within 60 seconds of the adjustment, the old flow setting is restored.

c. If you cannot adjust the flow to within tolerance, replace the pump . If you still cannot make the flow adjustment, this indicates a fault in the measurement extension, which must be replaced.

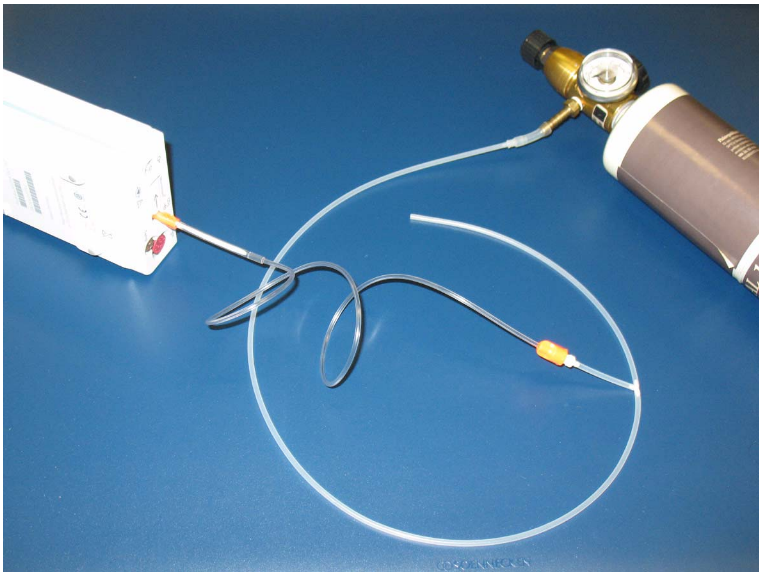
Note that the pump can only be replaced on M3015A with the old hardware Rev. A (i.e. Serial No. DE020xxxxx)

Test	Expected test results
Flow Rate Check	Flow rate is 50 +15/-7.5 ml/min

Noise Check

1 With the monitor in service mode, select **Setup CO_2** menu.

2 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the mCO_2 inlet.



3 Open the valve to apply the 5% calibration gas and wait until the value is stable.

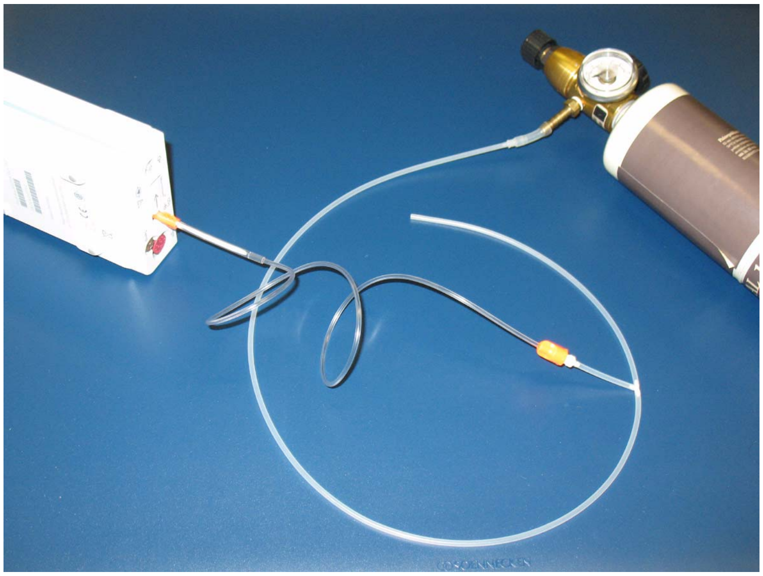
4 Check the noise index (**x6**) displayed next to the CO_2 value on the display (this indicates the level of noise on the CO_2 wave). If the value exceeds 3 mmHg, replace the measurement extension.

Test	Expected test results
Noise Check	**x6** = noise index displayed on monitor (**x6**<3.0)

CO2 Cal Check and Calibration

After switching the measurement extension on, wait at least 20 minutes before checking the calibration. Check the calibration of the CO_2 gas measurement as follows:

1 Connect the calibration line, the cal tube, the flow regulator and the 5% calibration gas to the mCO_2 inlet.



2 Calculate the expected measurement value in mmHg as follows:
0.05 x (ambient pressure) = value mmHg
for example 0.05 x 736 = 36.8 mmHg (with an ambient pressure of 736 mmHg)

3 Open the valve on the flow regulator to allow 5% CO_2 gas to flow into the extension. Allow the value to stabilize.

4 Check that the value on the instrument (measurement value on the main screen, **x7**) matches the calculated mmHg value ± 2.6 mmHg.
If the value is outside the tolerance, calibrate as described in step 8a to 8e below.

5 Disconnect the 5% calibration gas and connect the 10% calibration gas.

6 Calculate the expected measurement value and tolerance in mmHg as follows:
0.1 x (ambient pressure) = value mmHg
±0.07 x (value mmHg) = tolerance
for example 0.1 x 737 mmHg = 73.7 mmHg (with an ambient pressure of 737 mmHg)
±0.07 x 73.7 mmHg = ±5.16 mmHg tolerance

7 Open the valve on the flow regulator to allow 10% CO_2 gas to flow into the extension. Allow the value to stabilize.

8 Check that the value on the instrument (**x8**) matches the calculated mmHg value within the calculated tolerance. If so, the measurement extension is correctly calibrated.
If the value is outside the tolerance, calibrate as follows.

a. Keep the same setup and connect the 5% calibration gas.

b. Select **Cal.** $\mathbf{CO_2}$.

c. Select the value for the calibration gas. (The default value is 5.0%.)

d. Open the valve on the calibration gas to allow CO_2 gas to flow into the extension. Allow the value to stabilize before the start of the calibration. Leave the valve open until the instrument gives a prompt that gas can be removed.

e. The extension calibrates and prompts when calibration is successful.

Test	Expected test results
CO2 Cal Check	x7 = calculated mmHg value ±2.6 mmHg x8 = calculated mmHg value within calculated tolerance

Calibration Verification

1 Keep the same setup as described in "CO2 Cal Check and Calibration" on page 77.

2 Reopen the 5% gas valve and allow the value to stabilize.

3 Check that the value displayed on the monitor is correct within the tolerance (see step above).

4 Disconnect the 5% calibration gas and connect the 10% calibration gas.

5 Open the valve on the flow regulator to allow 10% CO2 gas to flow into the extension. Allow the value to stabilize.

6 Check that the value displayed on the monitor is correct within the tolerance (see step above).

If one or both values are not within tolerances, you must exchange the M3015A/B MMS Extension or the MP5 mCO_2 Assembly.

Test	Expected Test Results
Leakage Check parts 1 and 2*	**x1** = value of part 1 leakage check on flowmeter (**x1**< 4.0 ml/min) **x2** = value of part 2 leakage check on flowmeter (**x2**< 4.0 ml/min)
Leakage Check without Flowmeter	reading on the digital barometer change is less than 20 mbar for 30 seconds
Barometric Pressure Check	**x3** = difference between the reference pressure and the measured ambient pressure displayed on the monitor (**x3**<12 mmHg)
Flow Check	**x4** = difference between measured value and 50.0 ml/min (**x4** = 50+15/-7.5 ml/min)
Noise Check	**x5** = noise index displayed on monitor (**x5**<3.0)
CO_2 Gas Calibration Check	**x6** = difference between measured CO_2 value and calculated value, based on 5% CO_2 cal. gas. (**x6** < 2.6 mmHg)
CO_2 Cal Verification	**x7** = difference between measured CO_2 value and calculated value, based on 10% CO_2 cal. gas. (**x7** < ± {0.07 x value calculated})

* M3015A HW Rev. B and FW Revision < P.01.32 only

Spirometry Performance Tests

These tests verify the performance accuracy of the M1014A Spirometry module.

Equipment Required

- Leak test kit (Part number: M1014-64100)
- calibrated barometer
- M2785A Pediatric/Adult Flow Sensor
- 500ml calibration syringe, Hans Rudolph model 5550 or equivalent

Flow Test

1. Connect the M1014A Spirometry Module to the host monitor and go into service mode.
2. Connect the flow sensor to the module.
3. Connect the 500ml calibration syringe to the flow sensor. Make sure the syringe is set to the “empty” position.
4. Press the **Setup** key on the module and select **Show all Values** in the **Setup Spirometry** menu.
5. Pump the calibration syringe back and forth with a steady motion at a rate of 20 cycles and verify that the readings for TVexp and TVin are 500 ± 25 ml.

If the readings are not within the specified range, try another flow sensor. Ensure that the syringe is calibrated correctly and that the procedure is performed exactly as described above. If the test fails again, replace the module.

Test	Expected test results
Flow Test	TVexp and TVin are 500 ± 25 ml

Leakage Test

1. Connect the M1014A Spirometry Module to the host monitor and go into service mode.
2. Connect the leak test adapter to the module.
3. Press the **Setup** key on the module and then select **Show all Values** in the **Setup Spirometry** menu.
4. Press the Purge key on the module and start a purge cycle. At the end of the purge cycle, the values for Paw and Ppeak should both be above 100 cmH2O.
5. Verify that the pressure difference between Ppeak and Paw remains less than 10 cmH2O after 30 seconds.

If the readings are not within the specified range or if an INOP (e.g. SPIRO PURGE FAILED) is issued, check the leak test adapter for any leaks. Disconnect the adapter from the module and start the test procedure from the beginning. If the test fails again, replace the module.

Test	Expected test results
Leakage Test	Paw and Ppeak >100 cmH2O

Barometer Check

1. Connect the M1014A Spirometry Module to the host monitor and go into service mode.
2. Attach any airway adapter to the module.

3 Press the Setup key on the module and then select **Show all Values** in the **Setup Spirometry** menu.

4 Check that the barometric reading (PB) is within ± 5 mmHg of a reference barometer.

5 If the readings are not within the specified range, check the accuracy of the barometric pressure reference again. If the test fails again, replace the module.

Test	Expected test results
Barometer Check	PB is within ± 5 mmHg of a reference barometer

NOTE

The built-in barometer cannot be recalibrated.

Cardiac Output (C.O.) Performance Test

These tests check the performance of the cardiac output measurement.

1 Connect the patient simulator to the C.O. module using the patient cable.

2 Configure the patient simulator as follows:
Injection temperature: 2 °C
Computation Const: 0.542
(Edward's Catheter)
Flow: 5 l/min

3 Check displayed value against the simulator configuration.

4 Expected test result: C.O. = 5 +/– 1 l/min.

Test	Expected test results
Cardiac Output Performance Test	C.O. = 5 +/– 1 l/min

Service Tool Procedure, Version 1

This procedure applies for Service Tool M1012-61601 in combination with C.O. modules without option C10 and M3012A MMS extensions with option C05.

1 In monitoring mode, connect the C.O. interface cable to the module.

2 Connect one side of the service tool to the injectate receptacle of C.O. interface cable and the other side to catheter cable receptacle.

3 Enter the **C.O. Procedure** window and check the results. The expected test result is:

Tblood = 37.0^{o}C +/- 0.1^{o}C

Test	Expected test results
Cardiac Output Service Tool Procedure Version 1	Tblood = 37.0^{o}C +/- 0.1^{o}C

Service Tool Procedure, Version 2

This procedure applies only for Service Tool M1012-61601 in combination with C.O. modules with option C10 and for the M3012A MMS Extension with option C10.

1 In monitoring mode, connect the C.O. interface cable to the module.

2 Connect one side of the service tool to the injectate receptacle of the C.O. interface cable and the other side to the catheter cable receptacle.

3 Enter **C.O. Procedure** window and check results for:

- Method of measurement
- Arterial Catheter constant
- Tblood

The expected results are:

- Transpulmonary
- 341
- Tblood = 37.0°C +/- 0.1°C

4 Make sure the main alarms are switched on.

5 Disconnect the Catheter cable receptacle from the service tool

6 Enter the Setup C.O Window and change the method of measurement to “Right Heart”

7 Enter the C.O. Procedure window and check the Tinj value. The expected result is:

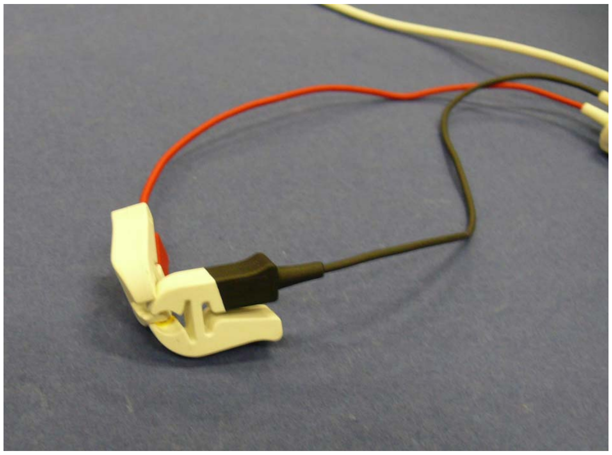
Tinj = 0.0°C +/- 0.1°C

Test	Expected test results
Cardiac Output Service Tool Procedure Version 2	Tinj = 0.0°C +/- 0.1°C

NMT Performance Test

NMT Stimulation Output Test

1 Short circuit the stimulation cables by connecting the two cable clamps to each other as shown below.



2 In service mode, select the **Setup NMT** menu.

3 Select **Start Test**.

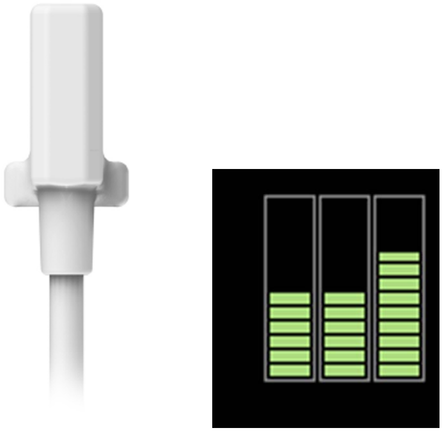
4 Select **Confirm**.

Test	Expected test results
NMT Stimulation Output Test	**NMT Stimulation Output Test passed** is displayed on the monitor.

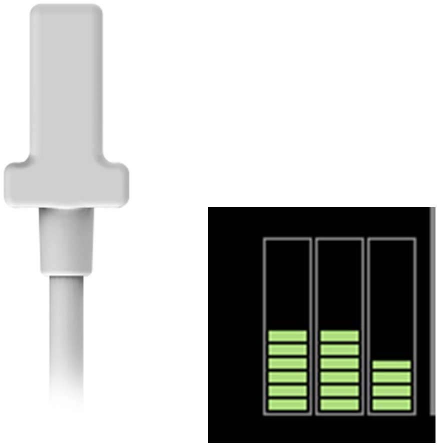
NMT Transducer Test

1 Go into Service Mode. In Service Mode the NMT Bar Graph only contains three bars instead of four.

2 Place the NMT Transducer on a flat surface with the flat side facing downwards. Two of the three bars in the NMT bar graph should be at the same level and the third one should be higher than the other two.



3 Turn the NMT Transducer 180° and place it on a flat surface with the flat side facing upwards. The bar that was higher than the other two before should now be lower than the other two by approximately the same amount.



Test	Expected test results
NMT Transducer Test	First two bars in the NMT bar graph are at the same level, third bar is higher when the flat side of the transducer is facing downwards and lower by the same amount when the transducer is facing upwards.

IntelliBridge Performance Test

This test checks the performance of the IntelliBridge EC10 & EC5 modules.

Tools required: none / external device (i.e. ventilator) and the required IntelliBridge EC5 Module

1. Plug the IntelliBridge EC10 module into the Philips patient monitor or run the test with the built-in EC10 I/O board.
2. Connect the Service PC to the IntelliBridge EC10 module or I/O board and make sure the correct drivers for the external devices are installed. (See the chapter for details).
3. Depending on your external device, connect the appropriate EC5 ID module (indicated on the EC5 label) to the external device.
4. Connect the EC5 to the EC10 module or I/O board using the supplied cable.
5. Switch the external device on. The connection status LED will flash green until it has correctly identified the external device and started communication. Check that the connection status LED then lights green continuously indicating that communication has been established. Information from the external device should now be available on the Philips patient monitor.
6. Select **Main Setup** -> **Measurements** -> **<External Device Name>** to enter the setup menu for the connected device.
7. Select **Setup Waves** or **Setup Numerics** and make any required changes.
8. Close the setup menu.
9. Select the wave segment on the screen, in which you want the waves to be displayed. In the pop-up menu, select Change Wave, and then select WAVE.
10. We recommend that you confirm with the user that waves and numerics required from the external device are being accurately received. If the external device has a demo mode, use this.

Test	Expected test results
IntelliBridge Performance Test	Numerics are visible on screen (pass/fail)

Recorder Performance Test - M1116C

This test checks the performance of the recorder module M1116C.

1. Load paper into the recorder (for paper loading instructions, refer to your monitor's Instructions for Use).
2. Start a recording, e.g. an Alarm Limits Recording.
3. If no print-out appears, the paper may be loaded backwards or the wrong paper may be inserted.
4. Try reloading the paper. Make sure you are using the correct paper.

Test	Expected test results
Recorder Performance Test	Recording is printed correctly

EEG, SvO2 (SO2) and tcGas Performance Tests

The EEG and SVO_2 (SO_2) parameters do not require performance tests because the modules perform internal self-tests regularly. These tests suffice for performance testing of these three parameters.

Since the tcGas Module is calibrated regularly it also does not require a separate performance test.

Nurse Call Relay Performance Test

The nurse call relay performance test can be performed at the Modular Jack 6P6C connector.

This test checks the operation of the Nurse Call Relay. The Nurse Call Relay test is recommended for customer sites where the nurse call is in use. The Nurse Call relay functions as follows:

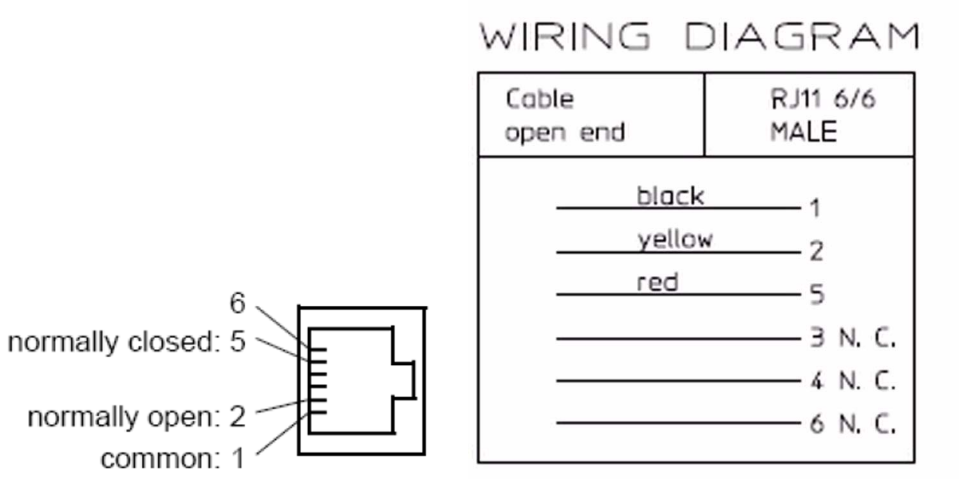
- Standard Operation—connector contact 1-2 open; 1-5 closed.
- Alarm Condition—connector contact 1-2 closed; 1-5 open.

Tools required: Ohmmeter.

1 Plug a 6P6C Modular Plug into the Nurse Call Relay connector.

2 Connect the ohmmeter.

3 When no alarm occurs, connector contacts 1-2 are open and connector contacts 1-5 are closed. When an alarm occurs, connector contacts 1-2 are closed and connector contacts 1-5 are open.

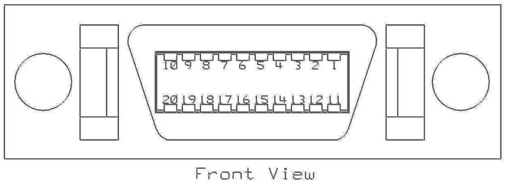

WIRING DIAGRAM
Cable open end
RJ11 6/6 MALE
black 1
yellow 2
red 5
3 N. C.
4 N. C.
6 N. C.
6
normally closed: 5
normally open: 2
common: 1

4 The expected test result is: Alarm condition - Connector contacts 1-2 are closed and connector contacts 1-5 are open.

Test	Expected test results
Nurse Call Relay Performance Test	Alarm Condition— Connector contacts 1-2 are closed and Connector contacts 1-5 are open

Multi-Port Nurse Call Connector Test (Flexible Nurse Call)

This test checks the operation of the Flexible Nurse Call Relay. The Nurse Call Relay test is recommended for customer sites where the nurse call is in use. The following diagram and table show the pins and relay identifiers of the connector:


10 9 8 7 6 5 4 3 2 1
20 19 18 17 16 15 14 13 12 11
Front View

Pin	Cable Color Coding	Relay
1	black	R2-closure
2	brown	R2-middle
3	red	R2-opener
4	orange	R3-closure
5	yellow	R3-middle
6	green	R3-opener
7	blue	n/a
8	purple	n/a
9	gray	n/a
10	white	n/a
11	pink	R1-closure
12	light green	R1-middle
13	black/white	R1-opener
14	brown/white	n/a
15	red/white	n/a
16	orange/white	n/a
17	blue/white	R_failure_closure
18	purple/white	R_failure_middle
19	green/white	R_failure_opener
20	red/black	n/a

The Nurse Call relay functions as follows:

- During standard operation R1,R2,R3_opener are closed; R1,R2,R3_closure are open.
- During alarm condition—R1,R2,R3_opener are open; R1,R2,R3_closure are closed.

Tools required: Ohmmeter.

1 Plug an M8087-61001 cable into the Nurse Call Relay connector.

2 Connect the ohmmeter and measure the pins as indicated in the diagram and table.

3 The relay contacts should behave as described above. The behavior may vary depending on configuration choices. See the Configuration Guide for details on Alarm Relay settings.

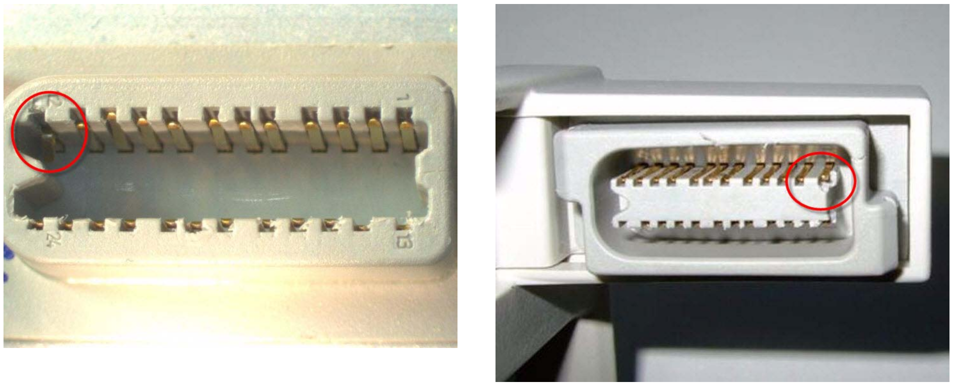
4 The expected test results depend on the relay contact used. Please check that the correct relay activity is initiated during alarm condition.

Test	Expected test results
Multi-Port Nurse Call Connector Test	Correct relay activity is initiated during alarm condition (pass/fail)

MSL Assurance Test

Visually inspect all MSL connector sockets (cable/monitor/MMS).

1. Make sure that the pins of the connectors are not jolted.
2. Make sure that no pin is bent inwards or outwards.
3. Exchange connectors that show any evidence of damage or breakage



Examples of damaged connectors

Test	Expected test results
MSL Assurance Test	Pins of connector not jolted/bent (pass/fail)

Power Loss Alarm Buzzer Performance Test

1. Switch on the monitor.
2. Disconnect the monitor from AC power.
3. The Power Loss Alarm Buzzer should beep for about one minute.
4. To switch off the alarm sound, either press the power button or connect the monitor to AC power

Test	Expected test results
Power Loss Alarm Buzzer Performance Test	Beep for one minute

IntelliVue 802.11 Bedside Adapter Communication Test

1. Make sure the LAN cable is disconnected from the rear of the monitor, then switch on the monitor.
2. Go into Service Mode and select **Main Setup -> Network -> Setup WLAN.** In the **Setup WLAN** menu:
   - set **Mode** to either **802.11Ah**, **802.11G**, **802.11Bg** (not recommended), **Auto** (not recommended) or **None** (this setting disables the wireless LAN functionality permanently), to match your wireless infrastructure installation.
   - set **SSID** to match your installation.
   - set the **Country** code to “1000”. Setting the country code to this value will automatically adjust the regulatory domain to match the configuration of the infrastructure. Do not set the country code to values other than “1000” unless otherwise instructed.

- set the **Security Mode** to match your installation.
- Enter the required keys/passwords.

3 Select **Main Setup** -> **Network** -> **WLAN Diagnostic** to access the WLAN Diagnostic window.

4 Proper installation of the IntelliVue 802.11 Bedside Adapter is assured by connecting to an access point over the wireless link. Place the monitor with the IntelliVue 802.11 Bedside Adapter installed in close proximity to the access point (e.g. if the access point is mounted on the ceiling, place the monitor directly below). Wait until the **Conn.Status** field in the service window shows *Authenticatd (for* Rel. C.0 monitors) or *Connected* (for Rel D.0 or higher). Take the monitor approximately 5 m away from the access point. There should be no walls or other obstacles between the monitor and the access point. The following should apply:

- Observe the **RSSI** (Received Signal Strength Indicator) value for at least 5 - 10 seconds. The **RSSI** value will fluctuate but should stay above 30 in a 5 m distance from the access point used. The wireless link should be active, i.e. the **Conn.Status** field should be *Authenticatd* (for Rel. C.0 monitors) or *Connected* (for Rel D.0 or higher), and the other fields should contain values. If the **RSSI** value is significantly lower, check the distance to the access point and the antenna orientation at the monitor. The antenna orientation should be vertical, but the physical placement of the monitor or other equipment within its vicinity as well as walls or other obstacles may influence the antenna orientation required to receive the best RSSI value.

5 If this test fails, retry in a different physical area with a different access point and/or check the credential settings in the monitor.

Test	Expected test results
IntelliVue 802.11 Bedside Adapter Performance Test	RSSI value above 30

IIT Communication Test

1 Make sure the LAN cable is disconnected from the rear of the monitor, then switch on the monitor.

2 Go into Service mode and, select **Main Setup** -> **Network** -> **Setup IIT**. In the Setup IIT menu, set the **RF Access Code** in each profile to match your installation.

3 Go into Service Mode. Select **Main Setup** -> **Network** -> **IIT Diagnostic** to access the Instrument Telemetry Diagnostic window.

4 Proper installation of the IIT module is assured by connecting to an access point over the wireless link. Place the monitor with the IIT module installed in close proximity to the access point (e.g. if the access point is mounted on the ceiling, place the monitor directly below). Wait until the **Conn.Status** field in the Instrument Telemetry Service window shows *Active. Take the monitor approximately 5 m away from the access point. There should be no walls or other obstacles between the monitor and the access point. The following should apply:*

- Observe the **RSSI** (Received Signal Strength Indicator) value for at least 5 - 10 seconds. The **RSSI** value should be around -50 ±10 in a 5 m distance from the access point used and the IIT link should be active, i.e. the **Conn.Status** field should be *Active* and the other fields should contain values. If the **RSSI** value is significantly lower, check the distance to the access point and the antenna orientation at both the monitor and the access point (both should be vertical).
- Remove the antenna. The **RSSI** value should be around -90 ±10. The IIT link may be active but the connection could be unreliable. The **Conn. Status** field may toggle between *Inactive* and *Seeking*. If the difference between the **RSSI** values measured with and without antenna is significantly lower, check the antenna and the antenna connector for damage and verify that the cable fom the IIT adapter to the antenna connector plate is connected properly.

5 If this test fails, retry in a different physical area with a different access point.

Error Conditions:

- The field **MAC IIT** should show a value **unequal to** 0000 0000 0000. If it does not, there is a communication problem between the monitor and the IIT adapter.
- With an incorrect RF Access Code or an incorrect or defective antenna installation, the fields **IP Address**,**Server IP**, **Subnet Mask**, and **RSSI** in the Instrument Telemetry Service window will stay blank. The field **Conn. Status** will slowly toggle between *Inactive* and *Seeking*.

6 Perform the Access Point Controller (APC) test blocks as described in the Philips IntelliVue Wireless Network Installation and Configuration Guide.

Test	Expected test results
IIT Communication Test	IIT Communication without interference

Short Range Radio (SRR) Performance Test

1 Make sure that the short range radio interface is configured as follows: SRR On and appropriate channel selected.

2 Assign a wireless remote control to the monitor as described in .

3 Check that you can operate the monitor with the remote control.

Test	Expected test results
SRR Performance Test	Wireless Remote Control functions correctly. Monitor can be operated with Remote Control

Mounting Integrity Test

Perform the Mounting Integrity Test

- whenever you have removed and reassembled a quick mount
- if one or both of the quick mount screws are loose
- if there is a clearance between the quick mount and the monitor bottom housing
- if the monitor mounting is unstable

Remove the monitor from the mount and disassemble the quick mount. Ensure that the threading of the MX400/450/500/550 is not damaged or separated from the chassis.

If the quick mount is damaged, exchange the quick mount.

Ensure that all quick mount screws are tight (1.3 Nm). Test the quick mount by pressing the quick release button. If it comes back out gradually and regularly, the quick mount is inserted correctly. If it gets stuck, the quick mount is not centered and must be reinserted correctly.

If you notice any damage to the threading of the MX400/450/500/550 chassis, send the MX400/450/500/550 in for bench repair.

Test	Expected test results
Mounting Integrity Test	All quick mount screws are tight. No damage to quick mount. No damage to threading of MX400/450/500/550. Quick release button comes back out gradually and regularly.

Reporting of Test Results

Philips recommends all test results are documented in accordance with local laws. Authorized Philips personnel report the test result back to Philips. While hospital personnel (biomedical engineers or technicians) do not need to report results to Philips, Philips recommends that they record and store the test results in accordance with local laws.

The following table lists what to record after completing the tests in this chapter. Record the results in the empty column in the Test and Inspection Matrix.

The following is a guide as to what your documentation should include:

- Identification of the testing body (for example, which company or department carried out the tests).
- Name of the person(s) who performed the tests and the concluding evaluation.
- Identification of the device(s) and accessories being tested (serial number, etc.).
- The actual tests (incl. visual inspections, performance tests, safety and system tests) and measurements required
- Date of testing and of the concluding evaluation.
- A record of the actual values of the test results, and whether these values passed or failed the tests.
- Date and confirmation of the person who performed the tests and evaluation.

The device under test should be marked according to the test result: passed or failed.

Carrying Out and Reporting Tests

Test Report

Testing Organization: Name of testing person: Date:	(Check one of the following three options) Test before putting into service (reference value) Recurrent Test Test after Repair
Responsible Organization:	
Device Under Test:	ID-Number
Product Number:	Serial No.:
Accessories:	
Measurement Equipment (Manufacturer, Type, Serial No., Calibration Date):	
Safety Test Method used	
Functional Test (parameters tested):	
Mains voltage and frequency used during safety testing:	

Test and Inspection Matrix

Test	**Test or Inspection to be Performed**	**Expected Test Results**	**Record the Results (mandatory for Philips Personnel only)**	
			What to record	**Actual Results**
Visual Inspection	Perform Visual Inspection	Pass or Fail	V:P or V:F	
Power On	Power on the unit. Does the self-test complete successfully	If Yes, Power On test is passed	PO:P or PO:F	
Noninvasive Blood Pressure Performance Tests	Perform the Accuracy Test	X1 = value displayed by monitor Difference <= 3mmHg	PN:P/X1 or PN:F/X1	
	Performance Leakage Test	X2 = leakage test value X2 < 6 mmHg	PN:P/X2 or PN:F/X2	
	Performance Linearity Test	X3 = value displayed by monitor Difference <= 3mmHg	PN:P/X3 or PN:F/X3	
	Performance Valve Test	X4 = value < 10 mmHg	PN:P/X4 or PN:F/X4	
Temperature Performance Test	Perform the Temperature Performance Test	X1= 40°C ± 0.2°C or 100°F ± 0.4°F	PT: P/X1 or PT: F/X1	

Test	Test or Inspection to be Performed	Expected Test Results	Record the Results (mandatory for Philips Personnel only)	
			What to record	Actual Results
All other performance tests	Perform the remaining parameter performance tests, if applicable	See expected results in test procedures	P: P or P: F	
Safety (1)	Perform Safety Test (1): Protective Earth Resistance	With mains cable: Maximum impedance (X1): <=300 mOhms	S(1):P/X1 or S(1):F/X1	*
Safety (2)	Perform Safety Test (2): Equipment Leakage Current - Normal Condition.	With mains cable: Maximum leakage current (X1):<= 100 µA	S(2): P/X1 or S(2): F/X1	*
Safety (3)	Perform Safety Test (3): Equipment Leakage Current - Single Fault Condition (Open Earth)	With mains cable: Maximum leakage current (X2):<= 300 µA	S(3): P/X2 or S(3): F/X2	*
Safety (4)	Perform Safety Test (4): Applied Part Leakage Current - Single Fault Condition, mains on applied part.	Maximum leakage current (X1): <=50 µA (CF)	S(4): P/X1 or S(4): F/X1	*
System (Sys 1-2)	Perform the system test according to subclause 19.201 of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16, if applicable, after forming a system	Equipment Leakage Current: Sys1 <= 100 µA (Normal Condition) Sys2 <= 300µA (Single Fault Condition	Sys: PSys1/PSys2 or Sys: FSys1/Fsys2	*
System (Sys 3)	Perform the system test according to subclause 19.201 of IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16, if applicable, after forming a system	Protective Earth Leakage Current if medical electrical system components are connected to the same Multiple Portable Socket Outlet: Sys3 <= 300 µA	Sys: PSys3 or Sys: FSys3	*
Key: P = Pass, F = Fail, X or Sys = test value to be recorded, * = Record the worst-case results and the associated switch positions (e.g. normal/reverse polarity)				

NOTE

All values for current and voltage are the root mean square (r.m.s.) values, unless otherwise stated.

Evaluation

	Yes	**No**
Safety and Functional Test passed		
Repair required at a later date, safety and functional test passed		
Device must be taken out of operation until repair and passed tests		
Device failed and must be taken out of operation.		

Notes:		
Next Recurrent Test:		
Name:____		
Date/Signature:______________________________________		

Evaluation of Test Results

The evaluation of the test results must be performed by appropriately trained personnel with sufficient product, safety testing and application knowledge.

If any test results are between 90% and 100% of the respective expected result, the previously measured reference values must be taken into consideration for the assessment of the electrical safety of the device under test. If no reference values are available, you should consider shorter intervals between upcoming recurrent tests.

NOTE

If any single test fails, testing must be discontinued immediately and the device under test must be repaired or labeled as defective. Be sure to inform the user about the test failure in writing.

Other Regular Tests

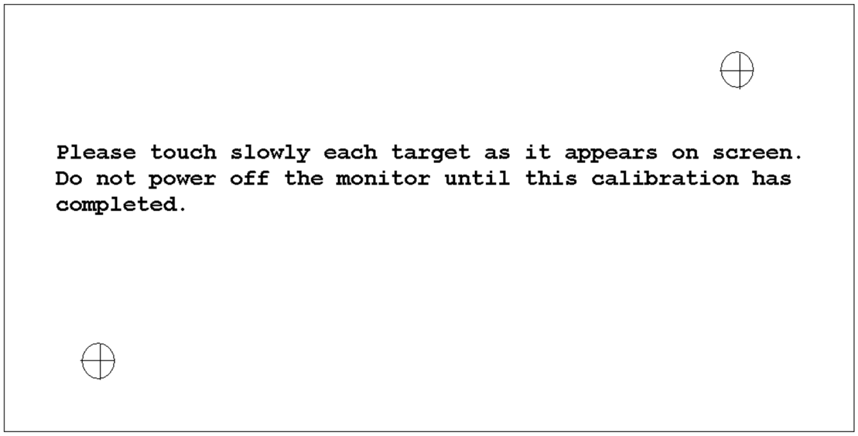
The care and cleaning requirements that apply to the monitor and its accessories are described in the Instructions for Use. This section `details periodic maintenance procedures recommended for the monitor and its accessories.

Touchscreen Calibration

To access the touchscreen calibration screen:

1. Enter service mode
2. Select **Main Setup**
3. Select **Hardware**

4 Select **Touch Calibration**



Please touch slowly each target as it appears on screen. Do not power off the monitor until this calibration has completed.

Touchscreen Calibration Screen

Make sure you complete the calibration procedure without powering off the monitor mid-way. If the monitor is powered off after the first point is touched, the touch panel will be deactivated until the touch calibration is performed again.

If the touchscreen is accidentally mis-calibrated by selecting the wrong spot, you must use another input device to re-enter calibration mode. If you have the Support Tool, you can initiate a touch calibration from there.

Please refer to the documentation shipped with your selected display for further details on touchscreen calibration procedures.

NOTE

If a touchscreen calibration is started on a multiple display system, the calibration is started for all displays at the same time.

Disabling/Enabling Touch Operation

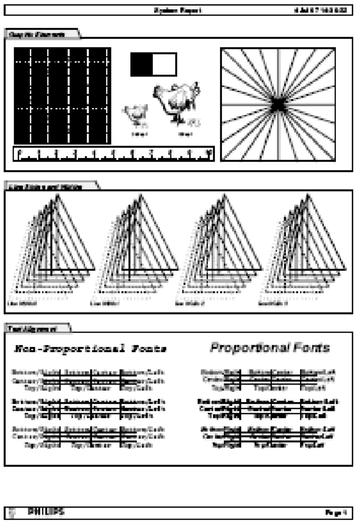
To *temporarily* disable touchscreen operation of the monitor, press and hold the **Main Screen** key. A padlock symbol will appear on the key. Press and hold the **Main Screen** key again to re-enable touchscreen operation.

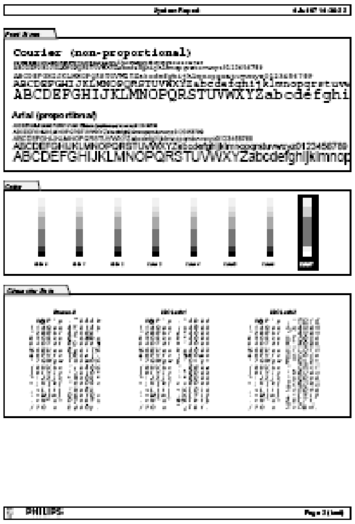
Printer Test Report

To verify your printer configuration you may want to print a test report.

To print a test report select **Main Setup** -> **Reports** -> **Setup Printers** -> **Print Test Rep.**

Your test report should look like this:





Battery Handling, Maintenance and Good Practices

This section provides some information on how to handle and maintain the battery in order to get the best usage from it. Additionally, some good working practices are also given regarding the correct disposal of the batteries.

Battery Care

Battery care begins when you receive a new battery and continues throughout the life of the battery. The table below lists battery care activities and when they should be performed.

Activity	When to Perform
Perform a visual inspection	Before inserting a battery into the monitor
Charge the battery	Upon receipt, after use, or if a low battery state is indicated. To optimize performance, a fully (or almost fully) discharged battery should be charged as soon as possible.
Condition the battery	When the "battery requires maintenance" symbol appears
Store the battery in a state of charge in the range of 40% to 50%	When not in use for an extended period of time

Refer to your monitor's Instructions for Use for details on how to perform battery care activities, including charging and conditioning. We recommend using the Philips Smart Battery Conditioner LG 1480 (865432)

Handling Precautions

Lithium ion batteries store a large amount of energy in a small package.Use caution when handling the batteries; misuse or abuse could cause bodily injury and/or property damage.

- Do not short circuit - take care that the terminals do not contact metal or other conductive materials during transport and storage
- Do not crush, drop or puncture - mechanical abuse can lead to internal damage and internal short circuits which may not be visible externally
- Do not apply reverse polarity
- Do not expose batteries to liquids
- Do not incinerate batteries or expose them to temperatures above 60°C (140°F)
- Do not attempt to disassemble a battery.

If a battery has been dropped or banged against a hard surface, whether damage is visible externally or not:

- discontinue use
- dispose of the battery in accordance with the disposal instructions

If a battery shows damage or signs of leakage, replace it immediately. Do not use a faulty battery in the monitor.

Storage

When storing batteries, make sure that the battery terminals do not come into contact with metallic objects, or other conductive materials.

If batteries are stored for an extended period of time, they should be stored in a cool place, ideally at 15°C (60°F), with a state of charge of 20% to 40%. Storing batteries in a cool place slows the aging process.

The batteries should not be stored at a temperature outside the range of -20°C (-4°F) to 60°C (140°F).

Do not store batteries in direct sunlight.

Stored batteries should be partially charged to 20% to 40% of their capacity every 6 months. They should be charged to full capacity prior to use.

NOTE

Storing batteries at temperatures above 38°C (100°F) for extended periods of time could significantly reduce the batteries' life expectancy.

Battery Lifetime Management

The lifetime of a Lithium Ion battery depends on the frequency and duration of use. When properly cared for, the useful life is approximately 3 years or 500 charge-discharge cycles, whichever comes first. In addition, experience indicates that the incidence of failure may increase with battery service life due to the accumulated stresses of daily use. We therefore strongly recommend that lithium ion batteries be replaced after 3 years or 500 charge-discharge cycles.

The age of a lithium ion battery begins at the date of manufacture. To see the date of manufacture and the number of charge-discharge cycles, select the battery symbol on the patient monitor screen.

The date of manufacture and the number of charge-discharge cycles are listed with other battery data on the screen.

WARNING

The risk of battery failure increases with age, when a battery remains in use longer than 3 years or 500 charge-discharge cycles. Such failures can result in overheating that in rare cases can cause the battery to ignite or explode.

Disposal

Batteries should be disposed of in an environmentally-responsible manner. Consult the hospital administrator or your local Philips representative for local arrangements.

Discharge the batteries and insulate the terminals with tape before disposal. Dispose of used batteries promptly and in accordance with local recycling regulations.

About the Battery

The rechargeable Lithium-Ion batteries used in the monitor are regarded as Smart batteries because they have built-in circuitry. (This circuitry communicates battery status information to the monitor.)

Actual current/voltage: depends on smart battery request and monitor configuration. The approximate charging time is 3 hours with the monitor switched off and up to 5 hours during monitor operation, depending on the monitor configuration.

NOTE

Batteries will discharge within about 20 days if they are stored inside the monitor without AC power connection.

Checking the Battery Status

When the Monitor is connected to the AC power supply, the battery charges automatically. The battery can be charged remotely from the Monitor by using the battery charger. Use only the 865432 Smart battery conditioner.

Battery status (level of charge) is indicated in several ways:

- LED on the front panel of the Monitor.
- Battery gauge.
- Display of battery time below gauge.
- Battery status window.
- INOP messages.

The AC Power LED is only on when the power cord is connected and AC power is available to the Monitor. In this case, the battery can be either charging or fully charged.

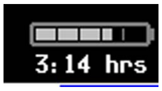
The battery LED can be green, yellow, or red depending on the following conditions:

Battery LED Colors	If the monitor is connected to AC power, this means	If the monitor is running on battery power, this means
Green	battery full (≥90%)	

Battery LED Colors	If the monitor is connected to AC power, this means	If the monitor is running on battery power, this means
Yellow	battery charging (battery power < 90%)	
Red, flashing		≤ 10 minutes power remaining
Red, flashes intermittently	battery or charger malfunction1,2	battery or charger malfunction1,2
Red, flashing when on/ standby switch is pressed		not enough battery power left to power monitor

1 indicated by malfunction symbol and INOP
2 for further details see Troubleshooting section

Battery Status on the Main Screen



Battery status information can be configured to display permanently on all Screens. It shows the status of the battery and the battery power and battery time remaining. The battery time is only displayed when the monitor is not running on AC power. Note that the battery status information may take a few minutes after the monitor is switched on to stabilize and show correct values.

Battery power gauge:

This shows the remaining battery power. It is divided into sections, each representing 20% of the total power. If three and a half sections are shaded, as in this example, this indicates that 70% battery power remains. If no battery is detected, the battery gauge is greyed out.

Battery malfunction symbols:

If a problem is detected with the battery, these symbols are displayed. They may be accompanied by an INOP message or by a battery status message in the monitor information line (if battery window is open) providing more details.

Battery Status Symbols	
🔋	Battery requires maintenance
🔋	Battery is empty
🔋	Battery not charging as the temperature is above or below the specified range
🔋	Charging stopped to protect the battery
Battery Malfunction Symbols	
?	Incompatible Battery

🔋	Battery Malfunction
🔋	Battery temperature too high
🔋	Battery has no power left

Explanations of Battery Status and Malfunction Symbols:

Battery requires maintenance: The battery requires conditioning. Refer to “Conditioning Batteries” for details.

Battery is empty: The capacity of the battery is ≤10 min. Recharge the battery as soon as possible.

Temperature outside specified range: The charging of the battery is stopped if the temperature is below 15°C or above 50°C in order to protect the battery. Charging is resumed as soon as the temperature is within this range.

Incompatible Battery: The inserted battery is checked for certain battery internal parameters. If these are not correct, the incompatible battery symbol is displayed. Please use only M4605A batteries with the MX400/450/500/550 monitor. Note that the incompatible battery symbol may also appear if there is a communication problem between the battery and the Standard System Interface board.

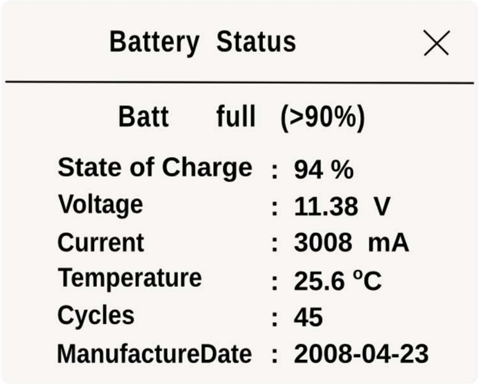
Battery Malfunction:Communication between the battery and the Standard System Interface board could not be established or battery internal data indicates malfunction. Please see the “Troubleshooting” section for remedies.

Battery Temperature too high: This symbol is displayed if the battery temperature goes above 65°C. In addition the INOP message CHECK BATT TEMP is displayed. If the battery temperature increases further above 70°C the batteries will switch off for safety reasons. Allow the battery to cool down to avoid the monitor switching off.

Battery has no power left: If the monitor is not running on AC power: battery will switch off power delivery at any moment - in this case recharge the battery immediately - or, if the monitor is running on AC power, the battery is in deep discharge and requires pre-charging to restore communication. To avoid this condition charge batteries to 50% for storage. Note that the battery malfunction INOP will eventually be issued if the pre-charging does not restore battery communication within about 4 minutes.

Battery Status Window

- To access the **Battery Status** window and its associated pop-up keys, select the battery status information on the Screen, or select **Main Setup** -> **Battery**.



Battery Status

Batt full (>90%)

State of Charge : 94 %
Voltage : 11.38 V
Current : 3008 mA
Temperature : 25.6 °C
Cycles : 45
ManufactureDate : 2008-04-23

State of Charge tells you the state of charge of the battery.

Time To Empty tells you approximately how long you can continue to use the monitor with this battery. Note that this time fluctuates depending on the system load (how many measurements and recordings you carry out), the age of the battery, and the remaining capacity of the battery. The time indication appears after AC has been unplugged for about 10 seconds (after finishing calculation of the Time to Empty)

Time To Full is shown in place of **Time To Empty** if the monitor is connected to AC power, and tells you how much time is left until the battery is charged to 90%. Please allow indication to stabilize for 3 to 5 minutes after beginning the charging cycle. If the battery is charged over 90% **Battery Full (>90%)** is displayed until they are charged to 100%. Then **Batt Fully Charged** is displayed.

Documenting Battery Status

To print all battery information in the **Battery Status** window,

1. Select the battery status information on the Screen or select **Main Setup** -> **Battery** to open the **Battery Status** window
2. Select the **Record Status** pop-up key to print the information on a recorder
   or
   Select the **Print Status** pop-up key to print the information on a connected printer.

Conditioning a Battery

What is Battery Conditioning?

Battery conditioning recalibrates the battery to ensure that it has accurate information on the actual battery capacity.

Why is Battery Conditioning Necessary?

The capacity of a battery decreases gradually over the lifetime of a battery. Each time a battery is charged its capacity decreases slightly. Therefore, the operating time of a monitor running on batteries also decreases with each charge cycle.

Battery conditioning ensures that the value stored in the battery for its full capacity takes account of this decrease, so that the remaining battery charge can be calculated accurately, and the low battery warning given at the right time.

When Should Battery Conditioning be Performed?

Battery conditioning should be performed once per year or when indicated by the Battery Status.

NOTE

When the battery status signals a conditioning request, the displayed **Time to Full** or **Time to Empty** may not be reliable.

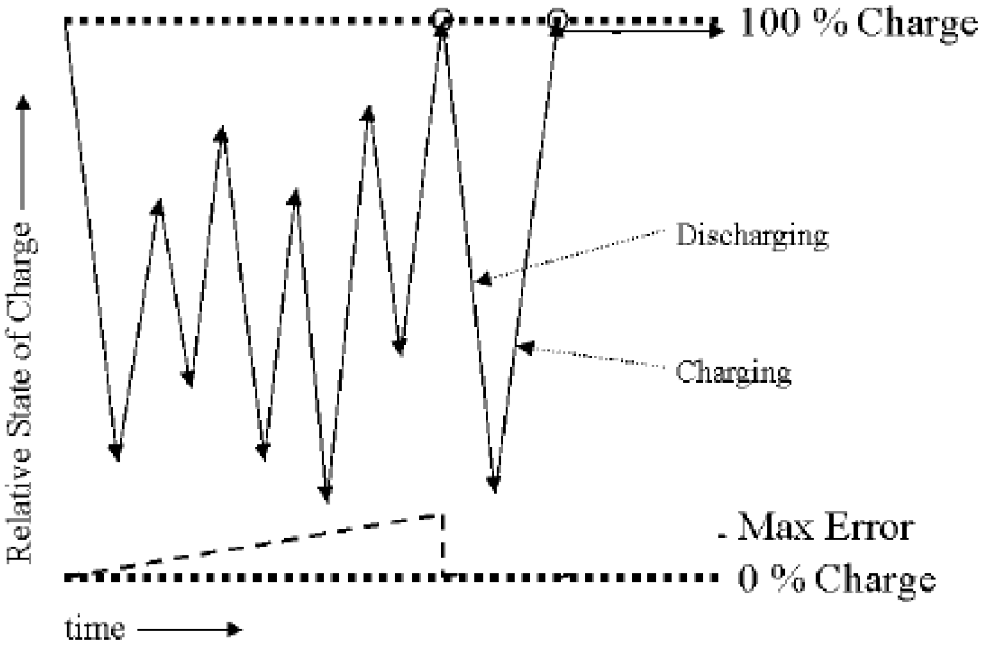
What Causes the Conditioning Message on the Monitor?

In addition to the value for the full capacity, the battery also stores a value for the Max Error. The Max Error tracks the maximum possible deviation of the estimated charge of a battery from the actual charge.

If a battery is charged or discharged partially, or if it is charged while the monitor is being used, the accuracy of the “reference points” for the fully discharged and fully charged states decreases, causing an increase in the value for the Max Error (see diagram, below).

When the Max Error rises over a certain limit, a message is displayed prompting the user to condition the battery, as described in .

You can reset the value for the Max Error before the battery needs conditioning, by performing the steps described in”Conditioning Batteries”. The minimum value of the Max Error after conditioning is 2%.



Conditioning Batteries

Battery conditioning can either be performed in the monitor or with an external battery charger. Philips recommends using the 865432 Smart Battery Conditioner to condition batteries.

Battery Conditioning in the Monitor

CAUTION

Do not use a monitor being used to monitor patients to condition batteries. The monitor switches off automatically when the battery is empty.

You should condition a battery when its “battery requires maintenance” symbol shows on the Screen. If conditioning is not performed immediately the monitor will still function according to specifications. However, the displayed time to empty and time to full will show increasing inaccuracy. Do not interrupt the charge or discharge cycle during conditioning. To condition a battery,

1. Insert the battery into a monitor connected to mains power.
2. Charge the battery until it is completely full. Switch the monitor off to decrease the charging time When the battery LED turns green i.e. the battery is >90% charged, switch on the monitor and open the **Battery Status** window. Check that the **Battery fully charged** message is displayed.
3. Disconnect the monitor from AC power, and let the monitor run until the battery is empty and the monitor switches itself off.
4. Reconnect the monitor to AC power and charge the battery until it is full for use or charge to 50% for storage.

Battery Conditioning with an External Charger

You can use the 865432 Smart Battery Conditioner for external battery conditioning. For details please see the IfU for the Smart Battery Conditioner. Use only the 865432 Smart Battery Conditioner.

After Installation, Testing or Repair

Before handing the patient monitor over to the end-user, make sure it is configured appropriately and that it is in monitoring mode. Ensure that the user receives the current revision of the monitor documentation.

4

Troubleshooting

Introduction

This section explains how to troubleshoot the monitor if problems arise. Links to tables that list possible monitor difficulties are supplied, along with probable causes, and recommended actions to correct the difficulty.

How To Use This Section

Use this section in conjunction with the sections *Testing and Maintenance* and *Parts*. To remove and replace a part you suspect is defective, follow the instructions in the section *Repair and Disassembly*. The *Theory of Operation* section offers information on how the monitor functions.

Who Should Perform Repairs

Only qualified service personnel should open the monitor housing, remove and replace components, or make adjustments. If your medical facility does not have qualified service personnel, contact Philips' Response Center or your local Philips representative.

WARNING

High Voltage - Voltages dangerous to life are present in the instrument when it is connected to the mains power supply. Do not perform any disassembly procedures (other than server and extension removal) with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

Replacement Level Supported

The replacement level supported for this product is to the printed circuit board (PCB) and major

subassembly level. Once you isolate a suspected PCB, follow the procedures in the Repair and Disassembly section, to replace the PCB with a known good PCB. Check to see if the symptom disappears and that the monitor passes all performance tests. If the symptom persists, swap back the replacement PCB with the suspected malfunctioning PCB (the original PCB that was installed when you started troubleshooting) and continue troubleshooting as directed in this section.

Software Revision Check

Some troubleshooting tasks may require that you identify the Software Revision of your monitor. You can find the software revision along with other information, such as the system serial number, in the monitor revision screen.To access the monitor revision screen:

1 Enter the Main Setup menu and select **Revision**

2 Select **Product**

3 Select **Software Revision**

4 Select the pop-up key for the device you want to check (e.g. **866060** or **M3001A)**

NOTE

The part numbers listed in the monitor revision screen do not necessarily reflect the part numbers required for ordering parts. Please refer to the *Parts* section for the ordering numbers.

NOTE

The system serial number can also be found on the lower right corner on the front of the monitor.

Software Compatibility Matrix

For a detailed software compatibility matrix, please refer to the IntelliVue Compatibility Matrix on InCenter or in the Service Bulletin SB86202000x, where x is the latest revision.

For further information on M3001A HW/SW compatibility, please refer to the *Parts* section.

Obtaining Replacement Parts

See *Parts* section for details on part replacements.

Troubleshooting Guide

Problems with the monitor are separated into the categories indicated in the following sections and tables. Check for obvious problems first. If further troubleshooting instructions are required refer to the Troubleshooting Tables.

Taking the recommended actions discussed in this section will correct the majority of problems you may encounter. However, problems not covered here can be resolved by calling Philips Response Center or your local representative.

Checks for Obvious Problems

When first troubleshooting the monitor, check for obvious problems by answering basic questions such as the following:

1 Is the power switch turned on?

2 Is the AC power cord connected to the instrument and plugged into an AC outlet?

3 Is the MSL cable connected correctly?

4 Are the MMS and, if present, the MMS Extension connected correctly?

5 Are the parameter modules plugged into the 3-Slot rack correctly?

Checks Before Opening the Instrument

You can isolate many problems by observing indicators on the instrument before it is necessary to open the instrument.

Checks with the Instrument switched Off

- AC connected, without battery:
  - AC Power LED is on (green).
- AC connected, with battery:
  - AC Power LED is on (green).
  - Battery LED is green if battery is fully loaded, yellow if battery is being charged.
  - Battery LED red and blinking signals battery or charger malfunction. See *Battery-related problems.*
- No AC connected, with battery:
  - All LEDs are off.

Checks with the Instrument switched On, AC connected, without battery

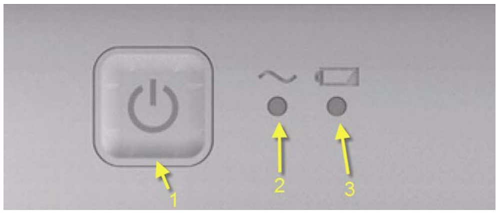
When the monitor is first switched on the AC Power LED switches on and stays on. The Power On/Error LED lights up red and then switches to green and stays on.

Checks with the Instrument switched On, AC connected, with battery

When the monitor is first switched on the AC Power LED switches on and stays on. The Power On/Error LED lights up red and then switches to green and stays on. Battery LED is either green or yellow

Checks with the Instrument switched On, AC not connected, with battery

When the monitor is first switched on the Power On/Error LED lights up red and then switches to green and stays on.



No.	Description
1	Power On/Error LED (Green/Red)
2	AC Power LED (Green)
3	Battery LED (Green/Red/Yellow)

Initial Instrument Boot Phase

The following table describes the regular initial boot phase of the monitor and its components. If the boot phase does not proceed as described below go to “Boot Phase Failures” on page 107 for Troubleshooting information.

Monitor Boot Phase:

For these steps it is assumed that the Monitor is powered correctly. This is indicated by the green Power On LED.

Time (sec.) after Power On	**Event**
0	AC Power LED is always on when monitor is connected to AC Power. When the Power On/Off button is pressed the red error LED switches on immediately.
1	The alarm LEDs are switched on with low intensity. Colors: Left LED: cyan; Middle LED: red; Alarm Suspend LED (right): red.
10	Boot Screen with the Philips Logo appears on the display. The red error LED is switched to green On/Standby LED.
15	Boot Screen with the Philips Logo disappears
20	Alarm LEDs are tested in the following sequence: Cyan on-off (left LED only) Yellow on-off (all LEDs) Red on-off (all LEDs) Fixed screen elements (for example smart keys, alarm fields) appear on the screen. Test Sound is issued.
22-30	First measurement information appears on the screen,user input devices (for example Navigation Point, Mouse, Touch) are functional

NOTE

The boot phase times may vary depending on the hardware and software revision of your monitor.

Troubleshooting Tables

The following tables list troubleshooting activities sorted according to symptoms. The possible causes of failure and the remedies listed in the troubleshooting tables should be checked and performed in the order they appear in the tables. Always move on to the next symptom until the problem is solved.

Boot Phase Failures

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
AC LED does not light up	Cable between AC/DC and standard system interface board disconnected.	Check the cable connection between AC/DC and standard system interface board.
	Cable between main board and power switch/ECG sync out board disconnected	Check the cable connection between the main board and the power switch/ECG sync out board
	LED defective	Try to switch on the monitor. If it operates normally , the LED is defective => exchange Power Switch board
	Power supply defective	Remove power supply and check if output voltage is within the specifications (15V ± 3%). Exchange power supply if defective
	I/O board defective	Remove I/O board and check again
	Advanced System Interface board defective	Remove advanced system interface board and check again
	Panel adapter board defective	Remove panel adapter board and check again
	Recorder board or rack board defective	Disconnect recorder board or rack board and check again.
	Standard system interface board defective	Exchange standard system interface board
	Main Board defective	Exchange Main Board

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Green Power On LED **and** Red Error LED remain off after pressing power on button	Power Switch Micro Controller hung	Unplug AC Mains and replug after 20 minutes. Try to switch on the monitor again
	Power switch/ECG sync out board not connected to the main board	Check if power switch/ECG sync out board is connected correctly to the main board
	Power switch/ECG sync out board defective	Exchange power switch/ECG sync out board and try to switch the monitor on again.
	I/O Board defective	Remove all I/O boards and try to switch the monitor on again
	Advanced system interface board defective	Remove advanced system interface board and check again
	IIT defective WLAN board defective Panel adapter board defective Recorder board defective Rack board defective	Disconnect all cables and boards (except Power Cable to the main board and to the standard system interface board and Power Switch cable): - IIT - WLAN - panel adapter - recorder - rack board then try to switch the monitor on again
	Standard system interface board defective	Exchange standard system interface board.
	Main board defective	Exchange main board. Add boards in reverse order and try again with each board.
Red Error LED stays on continuously	External connected device defective	disconnect all external cables (except AC) and switch the monitor on again
	I/O Board defective	Remove all I/O boards and switch the monitor on again.
	Advanced system interface board defective	Remove advanced system interface board and check again.
	IIT defective WLAN board defective Panel adapter board defective Recorder board defective Rack board defective	Disconnect all cables and boards (except Power Cable to the main board and Power Switch cable): - IIT - WLAN - panel adapter - recorder - rack board then try to switch the monitor on again
	Standard system interface board defective	Replace standard system interface board
	Main board defective	Exchange Main board

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Power On/Off LED switches between red and yellow (indicating that ASW cannot be loaded)	Hardware or Software Failure	Connect Support Tool directly to monitor with crossover cable and start “search for defective devices” If no device is detected, proceed as described above in section “Red error LED stays on continuously”
	Software Fault	If the Support Tool can detect the device and it indicates the Operating Mode is ‘Boot’, download and store the status log. Reload software and re-clone the monitor. If this fixes the problem e-mail the status log to your local response center
	Hardware Failure	If this does not rectify the problem follow instructions under “Red Error LED stays on continuously”.
Alarm LEDs remain off		Check for INOPS and follow instructions
	Cable between main board and panel adapter board not connected correctly or defective	Check cable connection between main board and panel adapter board. Replace cable if necessary.
	Cable between panel board and Alarm LED board not connected correctly or defective.	Check cable connection between panel adapter board and Alarm LED board. Replace cable if necessary.
	Alarm LED board is defective (MX450/MX500/MX550)	Exchange Alarm LED board
	Panel adapter board defective (MX400)	Exchange panel adapter board
	Main board defective	Exchange Main board
No Test Sound issued		check for INOPs and follow instructions
	Speaker defective	Exchange speaker
	Power switch/ECG out sync board defective	Exchange power switch/ECG out sync board
	Main board defective	Exchange main board

Integrated Display is blank

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Integrated display is blank or brightness is reduced (The information listed in this table is only valid if the boot phase has completed without error. See table for a description of the Boot phase.	Display brightness is reduced when room temperature, or instruments placed near patient monitor, causes the monitor display to overheat.	Instrument should be placed in an environment that does not exceed 40°C or below 5°C.
		If you have an external display, connect it to the video port. If the external display works, you can eliminate the connector board and the main board as the cause of failure.
	Backlight cable or cable from panel adapter board to main board not connected	Check cable connection of panel adapter board to backlight and main board.
	Panel adapter board defective	Replace panel adapter board
	Ambient Light Sensor on Alarm LED board defective	Replace Alarm LED board
	LCD Flat panel defective	Replace LCD Flat panel
	Main board defective	Replace main board

Integrated Touch Screen not functioning

Symptoms	**Possible Causes of Failure**	**Failure Isolation and Remedy**
Touch Screen not functioning	Touchscreen functionality has been temporarily disabled	Check if touchscreen functionality has been temporarily disabled (padlock symbol on Main Screen key). If yes, press and hold the Main Screen key to re-enable touchscreen operation.
	Touchscreen functionality has been permanently disabled	In service mode, select Main Setup -> User Interface and change the “Touch Enable” selection to “yes”.
	Touch screen not connected	Check connection from touch screen to panel adapter board
	Cable between main board and panel adapter board not connected	Check cable connection between panel adapter board and main board.
	Panel adapter board defective	Replace panel adapter board
	Touch screen defective	Replace touch screen assembly
	Main board defective	Replace main board
Touch Position invalid	Touch not calibrated	Perform touch calibration: 1. Go into service mode 2. Enter the Main Setup Menu 3. Select Hardware 4. Select Touch Calibration

External Display is blank (Slave Display)

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Display is blank		If integrated display is also blank proceed as described under “Integrated Display is blank”
	Option #J15 (Adaptive Slave Display) is not installed	Install option #J15 to activate the DVI video interface
	Video cable to external display not connected	Check video cable connection to external display
	External display has no power	Check electricity supply of external display
	External display is defective	Check external display and video cable on another monitor or PC
	Connector Board defective	Replace Connector board
	Main board defective	Replace main board

External Touch Display not functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
External Touch Screen not functioning	Touchscreen functionality has been temporarily disabled	Check if touchscreen functionality has been temporarily disabled (padlock symbol on Main Screen key). If yes, press and hold the Main Screen key to re-enable touchscreen operation.
	Touchscreen functionality has been permanently disabled	In service mode, select Main Setup -> User Interface and change the “Touch Enable” selection to “yes”.
	External Touch cable not connected	Check cable connection from external touch to Dual MIB I/O Board or RS232/5V interface on advanced connector board.
	External Touch driver configuration	Check MIB/RS232 configuration: 1. Enter Main Setup menu 2. Select Monitor 3. Select Hardware 4. Reconfigure MIB/RS232 drivers 5. if problem persists, proceed to the next step
	Dual MIB I/O board or advanced connector board defective	Replace MIB I/O board or advanced connector interface board
	External touch defective	Replace external touch
	Standard connector board defective	Replace standard connector board
	Main board defective	Replace Main board
Touch position invalid	Touch not calibrated	Perform touch calibration: 1. Enter Main Setup menu 2. Select Hardware 3. Select Touch Calibration

General Monitor INOP Messages

INOP Message	Possible Causes of Failure	Failure Isolation and Remedy
Checkinternvoltage Check Monitor Func	Problem with too low voltages (5V, -6V) in the monitor. Alarm lamps, display or interfaces may not function correctly. ECG does not function properly	Remove all I/O boards, recorder board and advanced system interface board, and put them back in and reconnect cables one at a time to isolate any defective board. If this does not resolve the problem, replace the main board
Check Monitor Temp	The temperature inside the monitor is too high	Check the environment for possible causes
	Monitor ventilation obstructed	Clean the monitor ventilation internally and then cool monitor down for 8 hours
	Main Board defective	Replace Main Board
Settings Malfunction	Problem during cloning process.	Reclone configuration file
	Memory space in which the settings are stored has been corrupted	Reclone configuration file. This will reload the memory space.
	Main board defective	Replace Main board
Internal Comm.Malf.	Standard system interface board defective	Replace standard system interface board
	Main board defective	Replace Main board
MCC Unsupported	An MSL coupling cable has been connected to a device which does not support MSL coupling.	Use the MSL coupling cable only when connecting Dual CPU MP90 monitors to a D80 Intelligent display.

Remote Control (wired)

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Remote Control not recognized by monitor	USB connector defective	If feasible, try the remote control with another monitor. If problem persists, try another USB port. If side USB connector is defective replace side USB.
	Advanced connector board defective	Replace advanced connector board.
	Standard system interface board defective	Replace standard system interface board
	Remote Control not plugged according to USB connection rules	See "Connection of USB Devices" in this service guide for the correct connection of USB devices.
	Remote Control defective	Exchange Remote Control

Remote Control (wireless)

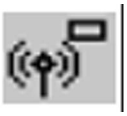
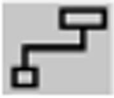
Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Remote Control not functioning	SRR option not enabled	Make sure that the SRR option is built in and enabled. See also “Short Range Radio Interface Problems” on page 122
	Low battery	Exchange battery
	Remote Control defective	Exchange Remote Control
Remote Control cannot be assigned to a monitor	Another remote control is assigned to the monitor.	Remove any other remote control before assigning a new remote control to a monitor

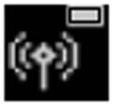
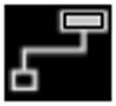
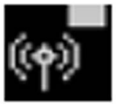
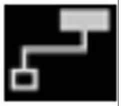
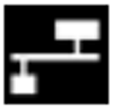
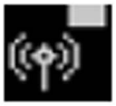
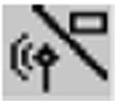
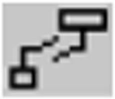
USB devices (e.g. Keyboard/Mouse) not functioning

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Keyboard/Mouse or other USB devices attached directly to the monitor not functioning	Device not connected properly	Check cabling
	Device defective	Replace Device (e.g. Keyboard/ Mouse)
	USB connector defective	Try another USB port. If side USB connector is defective replace side USB.
	Advanced system interface board defective	Replace advanced system interface board.
	Standard system interface board defective	Replace standard system interface board

Bedside Network Status Icons

The following table shows the icons displayed on the monitor when network related issues occur.

Wireless Icon	Wired Icon	Inverse Video	Blinks	Icon Comments	INOP Message	What does it mean?
No Icon	No Icon	-	-	-	-	MONITOR does not have a LAN connection (Wireless Monitor cannot find an access point to talk to, wired Monitor cannot hear anything on its LAN connection)
		Yes	Yes	Central - outline only	"Unsupported LAN" (after 1 minute)	MONITOR has a LAN connection but does not have an IP address assignment (Wireless MONITOR has found an access point to talk to, wired MONITOR hears traffic on the LAN)

Wireless Icon	Wired Icon	Inverse Video	Blinks	Icon Comments	INOP Message	What does it mean?
		No	No	Central - outline only	"No Central Monitoring"	MONITOR is connected to the LAN and has an IP address assignment, but the bed is not being monitored at the central 1. MONITOR is not assigned to a sector 2. There is another monitor on the network with the same "Equipment Label"
		No	No	Central - solid box	-	Normal Operation - MONITOR assigned to a sector and is being monitored by a central
-		No	No	Central - solid box, network line extended	-	Normal Operation MONITOR assigned to a sector and is being monitored by a central. This monitor also has OVERVIEW functionality on other beds.
	-	No	Yes	Central - solid box	"Wireless Out Of Range"	Wireless MONITOR that currently is being monitored by a central is losing contact with the access point and cannot find another to talk to.
		Yes	Yes	Central - outline only, line for broken connection to central	"No Central Monitoring"	Monitor lost connection to the Information Center: 1. LAN cable was disconnected 2. Information Center was disconnected 3. Network infrastructure failure (switch, etc.) 4. Out of range (wireless MONITOR)

Network related problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Prompt Message “no central assigned to this bed” is issued	The monitor label is not set in the monitor (if the beds are “monitor labeled” in the Philips Information Center)	Set Monitor Label in Config Mode
	Problem with the Philips Information Center to Switch communication (if the beds are “port mapped” in the Philips Information center	Check PIC to Switch communication, Switch configuration and Firmware status
INOP “Unsupported LAN” is issued	Network failure	Check if switches, Philips Information Center and Database Server are all running and connected to the network
	Monitor connected to wrong network	Check if monitor has been connected for example to a different hospital network instead of the Philips Clinical Network
	IP address conflict after infrastructure re-installation	Reboot Database Server and Philips Information Center
	IIT is enabled but no IIT infrastructure can be found	Move the monitor into the range of the IIT infrastructure or disable IIT in the **Setup IIT** menu if no IIT infrastructure is available.
No connectivity to PIC, no prompt or error message on monitor	Hardware Defect	Check LAN cable connection
		Check standard system interface board in Monitor
		Check Switch
	Configuration problem	Check switch configuration and firmware revision
Status Message “Incompatible SW Revision versions” is issued	Monitor and PIC software are not compatible	Check Software compatibility and upgrade to compatible software

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Other Bed Overview not available	Configuration Problem	Check configuration in PIC regarding other bed overview (care group assignment)
		Verify configuration of switch (setting of multicast filters)
	This function is not available for IntelliVue Instrument Telemetry and, in combination with earlier IntelliVue Information Center (IIC) revisions, for WLAN (IntelliVue 802.11 Bedside Adapter).	If you are using an IntelliVue 802.11 Bedside Adapter, check the software revision of the IntelliVue Information Center (IIC) to make sure it is compatible. If the software revision of the IIC is incomaptible or you are using IIT, switch to a wired configuration
"Other Bed" Alarms are not appearing	Configuration problem	Verify configuration in PIC, in Monitor (Config Mode) and check that the feature is not temporarily disabled by the user (Bed Info Window)

IntelliVue 802.11 Bedside Adapter Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
No Network icon or Network icon flashes. No association to central station.	Communication problem between the monitor and the IntelliVue 802.11 Bedside Adapter or RSSI value below 30.	Ensure that the network infrastructure is functioning properly. See Troubleshooting tables in the IntelliVue 802.11 a/g Infrastructure Installation and Configuration Guide for details. Check the antenna cable connection on the IntelliVue 802.11 Bedside Adapter. Check that the IntelliVue 802.11 Bedside Adapter is correctly connected to the panel adapter board. Check that the indicator behind the RSSI value (Main Setup -> Network -> WLAN Diagnostic -> RSSI) is rotating. If it is not, check IntelliVue 802.11 Bedside Adapter hardware. Replace antenna or IntelliVue 802.11 Bedside Adapter if necessary.
	IntelliVue 802.11 Bedside Adapter not yet operational	Check menu line 'Wireless LAN' (Main Setup -> Network -> WLAN Diagnostic -> Wireless LAN). If it shows 'Off', the wireless adapter is not yet operational. This does NOT indicate that WLAN has been disabled by a setting. If problem persists, check for an installed wired LAN cable.
	Configuration problem using WEP, WPA(PSK), WPA2(PSK).	Make sure that the Mode, SSID, Country and Security settings in the Setup WLAN menu match your installation
	Configuration problem using WPA Enterprise or WPA2 Enterprise	1. Check the connection status.(Main Setup -> Network -> WLAN Diagnostics -> Conn.Status) If the state only shows 'Scanning', make sure that the Mode, SSID, Country and Security settings in the Setup WLAN menu match your installation.

Symptoms	Cause of Failure	Failure Isolation and Remedy
		2. Check the connection status. If the device shows the state 'Authenticating', your SSID, Mode, Country and Security settings are correct. You already have a WLAN connection to your Access Point, but the device fails to authenticate, check your authentication server and WLAN controller error log.
		3. As an investigation step, disable the CertificateCheck. (Main Menu -> Network -> WLAN Setup -> CertificateCheck) If authentication is now possible, proceed with step 4. Otherwise double check your authentication server configuration, WLAN controller configuration and the user credentials (User Name, Password, Anonymous Identity). Note: If the previously used credential settings were wrong, the device is perhaps on the exclude list of your WLAN Controller. Resolve this issue on your WLAN controller. Note: **Do not forget to re-enable the certificate check**.

Symptoms	Cause of Failure	Failure Isolation and Remedy
		4. Check the time setting of the device (Main Setup -> Date, Time). If not correctly set, the used certificates are detected as invalid. Adjust to the correct time.
		5. Check the installed CA certificate using the support tool. - Task -> Clone from Medical Device - Open the cloned file using Configuration -> Configuration Editor - In Configuration Editor check Configuration -> Hardware -> Network -> Certificate 1 for validity(Valid from, Valid until)
		6. Make sure that the installed CA certificate is the root certificate of your authentication server certificate chain.

IIT-related Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
No Network icon or Network icon flashes. No association to central station.	Communication problem between the monitor and the IIT adapter. MAC Instr. Tele. field in Instrument Telemetry Service Window is 0000 0000 0000	Check that RF Access Code is set correctly and the network is correctly set up. Check the cable connection to the IIT module. Check the antenna cable connection between the IIT module and the antenna. Replace cable, antenna or IIT module if necessary.
	Incorrect RF Access Code. No IP Address.	Check that RF Access Code is set correctly. Make sure that network is set up correctly.

Short Range Radio Interface Problems

Symptoms	Cause of Failure	Failure Isolation and Remedy
Measurement selection icon does not change to SRR.	Assignment of SRR device to monitor not possible	Check SRR Configuration Settings. Replace defective SRR interface or cable, if necessary. Make sure SRR interface is installed.
	SRR interface of telemetry transceiver defective or incompatible	Make sure the telemetry transceiver SRR interface is compatible and functional.
Measurement selection icon changes to SRR but Assignment of SRR device to monitor fails. **SRR Interference** INOP is issued	RF Interferences	Check location for RF interferences and free frequencies by performing a site survey (e.g. with air magnet tool).
Communication Dropouts or gaps in parameter waves. **SRR Interference** INOP may be issued	RF Interferences	Check location for RF interferences and free frequencies by performing a site survey (e.g. with air magnet tool).
	Too many SRR devices allocated to one SRR channel	Up to two SRR connections can be established per channel. Check SRR Configuration Settings.
SRR communication aborted. **SRR Interference** or **SRR Invalid Chan** INOP may be issued.	RF Interferences	Check location for RF interferences and free frequencies by performing a site survey (e.g. with air magnet tool).
	Too many SRR devices allocated to one SRR channel	Up to two SRR connections can be established per channel. Check SRR Configuration Settings.
	SRR device out of range (either monitor or Telemetry Transceiver)	Position the SRR devices closer to each other. Check SRR signal quality indicator for signal strength.

Multi-Measurement Module

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Prompt message “Measurement Server Configuration not supported” is issued	An unsupported MMS Extension has been connected	Disconnect the MMS Extension
	MMS Extension is defective	Replace MMS Extension
	Measurement Server defective	Replace Measurement Server
INOP Message “MsmtSrv not Supp” is issued	Wrong Software Revison	Upgrade monitor and/or measurement server to a matching software version. Refer to for a list of compatible measurement servers.
	Too many measurement servers connected	Disconnect unsupported measurement servers for proper operation.
	Unsupported type of measurement server (for example M3000A) connected.	Disconnect the unsupported measurement server. Refer to for a list of compatible measurement servers.
Prompt message “Measurement Server not supported, unplug device, switch monitor off/on” and INOP “Bad Measurement Server are issued	M3000A Measurement Server Revision A is plugged. This Measurement Server is not compatible with the IntelliVue patient monitors. Parameter board defective.	Disconnect the measurement server and cycle power. Check if all measurements are displayed in the measurement selection window. Exchange MMS/Repair parameter board, if necessary.

MSL-related problems

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Measurement Server does not start up (no LEDs active), no INOP or prompt displayed	No Power	Check MSL cable and replace if necessary
		Replace SRL board' standard connector board or main board.
Measurement Server does not start but LEDs are normal	Communication lines in MSL cable or MSL connector broken	Check MSL cable and MSL connectors
	Cable between MSL board and main board not connected correctly	Check connection between MSL board and main board.
	MSL board or Main board defective	Check MSL board and replace if necessary. If problem persists, replace main board.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
MSL Power High INOP is issued Note: if this condition persists for longer than 15 minutes, the INOP MSL Power Off will appear (see below)	Attached devices drawing too much power from the monitor. Too many MMS connected to the monitor	Reduce to a limit of one MMS connected to the monitor.
MSL Power Off INOP is issued	Attached devices drawing too much power from the monitor. Too many MMS connected to the monitor	Disconnect all MMS from the monitor Cycle power to restore power to the MSL devices. If the message disappears, reconnect MMS one at a time, waiting 15 minutes between each device to see if message reoccurs. If yes, the respective MMS is faulty. See “Multi-Measurement Module” on page 123 for troubleshooting tasks. If no, add front-end modules one at a time, waiting 15 minutes between each module to see if message reappears, Replace module if faulty. Note: If an individual defective device is connected the MSL Power High or MSL Power Overload INOPs will appear initially. The MSL Power Off INOP will not occur for at least 15 minutes.
MSL Power Overload INOP is issued	Short Circuit within MSL system	Disconnect all MSL connections and reconnect devices one at a time. If message persists, replace standard system interface board.
INOP Bad Server Link is issued	Unexpected data detected on MSL	Check cable and power cycle the monitor
	An MMS with an incompatible software revision is connected to the monitor.	Connect MMS with compatible software revsion
	Communication between the components not functioning	Check software versions and model number of devices for compatibility

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message Serverlink Malf is displayed, audible indicator: a beep every two seconds	The hardware for communicating with the Multi-Measurement Server is faulty.	Check MSL cable, replace if necessary.
		Check MSL board. Replace if necessary
A measurement supported by a server does not come up on the monitor	Label conflict	A parameter label from this measurement is already in use in the monitor. Check the conflict window to select the measurement.
Prompt message "Too many <label> modules connected" is issued	There are more modules of the type <label> connected than supported by the software.	Remove the unsupported module or use the label manager application in the monitor to disable the module.
The ECG Out function does not funcion	Hardware problem	Check MSL cable
		Check ECG out hardware in the monitor (power switch/ECG sync out board)
		Check the MSL connector in the measurement server and the main board.

Battery Related Problems

Symptoms	Causes of Failure	Failure Isolation and Remedy
Batt Empty INOP tone, battery LED flashes During this INOP, alarms cannot be paused or switched off.	The estimated remaining battery-powered operating time of the battery is ≤ 10 minutes.	Recharge the battery immediately. If the condition persists, this INOP is re-issued two minutes after you acknowledge it.
Batt Incompat INOP tone	The indicated battery cannot be used with this monitor.	Replace with the correct battery (M4605A).
Batt Low INOP tone	The estimated battery-powered operating time remaining is less than 20 minutes.	Recharge the battery

Symptoms	Causes of Failure	Failure Isolation and Remedy
Battery Malfunct INOP tone, battery LED flashes During this INOP, alarms cannot be paused or switched off if the monitor is not connected to AC power.	The monitor cannot determine the battery status or there is a communication problem between the battery and the Standard System Interface board.	Replace the faulty battery. If the condition persists and the monitor is not connected to AC power, this INOP is re-issued two minutes after you acknowledge it. Check the battery in a different monitor or in a battery charger. If the INOP persists the battery is faulty. Check the Standard System Interface board with known good batteries. If the INOP persists, replace Standard System Interface board. If the problem persists, replace main board.
Charger Malfunct INOP tone, battery LED may flash	There is a problem with the battery charger in the monitor.	Switch the monitor off and back on again. If the problem persists replace battery with known good battery. If the INOP is shown again replace the Standard System Interface board. If the problem persists replace the main board.
Check Batt Temp INOP tone	The temperature of the battery is too high.	Check that monitor is not exposed to heat.

Alarm Lamps

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message Check Alarm Lamps is issued	Alarm LED board cable disconnected (MX450/500/550 only)	Reconnect Alarm LED board to panel adapter board
	Alarm LED board defective (MX450/500/550 only)	Replace Alarm LED board
	Cable between panel adapter and main board not connected correctly or defective	Check cable connection between panel adapter board and main board
	Panel adapter board defective.	Replace panel adapter board.
	Main board defective	Replace main board.

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
Alarm occurs, but no LED lights up	Environmental lighting too bright	Place monitor in a darker environment.
	Cable between main board and panel adapter board defective.	Replace cable.
	Alarm LED board cable disconnected	Reconnect Alarm LED board to panel adapter board
	Alarm LED board defective	Replace Alarm LED board
	Panel adapter board defective.	Replace panel adapter board.
	Main Board defective	Main board

Alarm Tones

Symptoms	Possible Causes of Failure	Failure Isolation and Remedy
INOP Message **Speaker Malfunction** is displayed	Speaker cable disconnected	Reconnect speaker cable
	Cable between power switch/ ECG sync out board and main board disconnected.	Check connection between power switch/ECG sync out board and main board.
	Speaker defective	Replace speaker
	Sound amplifier on main board defective	Replace main board
Alarm occurs but no alarm sound is issued	Audible alarm indicators have been switched off	Switch audible alarm indicators back on
	Volume set to 0	Increase volume
	Speaker defective	Replace speaker
	Sound amplifier on main board defective	Replace main board

Alarm Behavior

If your monitor did not alarm in the way in which the end user expected, please consult the Instructions for Use for possible setup issues or configuration settings which could affect alarm behavior.

Individual Parameter INOPS

If any of the following parameter INOP messages are issued try the respective parameter in another device. If the INOP message persists replace the parameter module, the MMS or other indicated device.

- **CO2 Equip Malf**
- **ECG Equip Malf**
- **NBP Equip Malf**

- <Pressure Label> Equip Malf
- RESP Equip Malf
- SpO2 Equip Malf
- SpO2 Transduc Malf
- <Temp Label> Equip Malf
- NMT Equip Malfunct
- NMT Incompatible
- NMT Cal Failed

Printer

Symptoms	Cause of Failure	Failure Isolation and Remedy
Prompt message “Print job could not be queued” is issued. No print device is found.	Printer is disabled in the Setup Printers menu	Enable the correct printer in the Setup Printers menu
	Paper size of printer does not match paper size of report	Change paper size of the printer in the Setup Printers menu or change paper size of the report in the Setup Reports menu.
Status message “Print device Local 1 (Local 2) unavailable” is issued. Printer job is stalled.	Printer not switched on	Switch on printer power
	Printer paper tray empty	Fill printer paper tray
	Cabling not connected correctly	Check cabling
	Standard system interface board defective	Replace standard system interface board
	Advanced system interface board defective	Replace advanced system interface board
Status message “Print device Remote 1 (Remote 2, Remote 3) unavailable” is issued. Printer job is stalled	Print error on Philips Information Center	Print a test report on the Philips Information center. If this fails, refer to Philips Information Center documentation
	Network Connection to Philips Information Center not functioning	Check that the network connection between the monitor and the Philips Information Center is working
Status message “Printing on device Remote 1... (Remote 2, Remote 3)” is issued but no report is printed	Print queue on Philips Information Center is full. Reasons for this may be: - Printer is not switched on - Printer paper tray is empty	Switch on printer power Fill printer paper tray

Symptoms	Cause of Failure	Failure Isolation and Remedy
Printouts are not as expected	Printer paper size is not correctly configured Printer resolution is not correctly configured Printer color support is configured to "On" although the printer does not support color Printer not compatible	Configure the paper size according to the inserted print media Configure the printer resolution according to the printer capabilities Configure the printer color support to "Off" Check specifications

Recorder

Symptom	Possible Cause	Corrective Action
System thinks that door is open when it is not.	Recorder board defective	Replace recorder board
	Defective door switch.	Exchange recorder.
System thinks that the recorder is out of paper when it is not.	Paper-out sensor dirty.	Clean paper-out sensor.
	Recorder board defective	Replace recorder board
Recorder not communicating with System.	Poor connection to the module rack	Unplug the module. Plug it back in and try it again in a few seconds. (Watch for the LED to flash)
	Only one recorder module may be used with each monitor	Remove one of the recorder modules
	System not configured properly.	Check the configuration of the connected monitor.
	Recorder board defective	Replace recorder board
Recorder won't run.	Recorder interface not working correctly.	Remove the recorder. Reinstall it and try it again in a few seconds.
	Recorder board defective	Replace recorder board
Poor print quality.	Print head dirty.	Clean the print head.
	Print head failure.	Exchange the recorder.
Paper not feeding properly.	Paper roll off center.	Center paper roll on roller guides.
	Dirty roller.	Clean roller.

Recorder M1116C

Symptom	Possible Cause	Corrective Action
Prompt "Local recorder out of paper" when it is not	Paper-out sensor dirty	Pull paper out a little bit and straighten the paper to make sure it is fixed tightly in the recorder. Make sure the paper has been loaded correctly and that the correct paper has been used.
Prompt "Local recorder door open" when it is not	Defective door switch	Exchange Recorder
Recorder does not lock into rack	Snap-lock defective	Exchange snap locks
Paper not feeding properly	Paper roll off center	Center paper roll
	Defective roller	Exchange Roller
Poor print quality	Paper not inserted correctly	Check that paper is inserted correctly
	Print-head failure	Exchange Recorder
Content of recording is not as expected	Monitor not configured properly	Check the configuration of the monitor
Recorder not communicating with system, not printing	Poor connection to rack	Unplug the module. Plug it back and try again in a few seconds (Wait that the LED flashes)
	Only one recorder module may be used with each monitor	Remove one of the recorder modules
	Monitor not configured properly	Check the configuration of the monitor
	Recorder defective	Exchange Recorder

MIB/RS232 Interface on I/O board

Symptoms	Cause of Failure	Failure Isolation and Remedy
Gas Analyzer connected to an RS232 port not functioning	The MIB/RS232 port is not configured for a Gas Analyzer	Check configuration of the MIB/RS232 ports in configuration mode
	The cable between the Gas Analyzer and the monitor is not connected correctly or defective	Check cable connection, replace cable if necessary
	The MIB/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The MIB/RS232 board is defective	Check board and replace if necessary
External device not receiving data	The MIB/RS232 port is not configured for data export	Check configuration of the MIB/RS232 ports in configuration mode
	The wrong data export protocol driver is configured in the monitor	Check the export protocol required by the attached device and configure the monitor accordingly
	The cable between the external device and the monitor is not connected correctly or defective	Check cable and replace if necessary
	The external device does not support the version of the data export protocol used in the monitor	Check if the device supports the version of the data export protocol. Upgrade device or monitor if necessary (if matching versions exist).
	A terminal concentrator is used in between the device and the monitor and a protocol with dynamic speed negotiation is used	Some terminal concentrators do not support changing the transmission speed (baud rate) dynamically. Check if the connection works without the concentrator
	The MIB/RS232 board is in a wrong slot (slot has been changed after software configuration or an additional board has been plugged in)	Verify correct placement of the I/O boards
	The MIB/RS232 board is defective	Check board and replace if necessary
Detailed Protocol Problem		Consult the Data Export Protocol document.

RS232/5V Interface on Advanced System Interface Board

Symptoms	Cause of Failure	Failure Isolation and Remedy
Gas Analyzer connected to RS232/5V port not functioning	The RS232/5V port is not configured for a Gas Analyzer	Check configuration of the RS232/5V port in configuration mode
	The wrong cable is being used	Use straight-through pinning cable
	The cable between the Gas Analyzer and the monitor is not connected correctly or defective	Check cable connection, replace cable if necessary
	The advanced system interface board is defective	Check board and replace if necessary
External device not receiving data	The RS232/5V port is not configured for data export	Check configuration of the RS232/5V port in configuration mode
	The wrong cable is being used.	Choose cross-over cable (or use an adapter)
	The wrong data export protocol driver is configured in the monitor	Check the export protocol required by the attached device and configure the monitor accordingly
	The cable between the external device and the monitor is not connected correctly or defective	Check cable and replace if necessary
	The external device does not support the version of the data export protocol used in the monitor	Check if the device supports the version of the data export protocol. Upgrade device or monitor if necessary (if matching versions exist).
	A terminal concentrator is used in between the device and the monitor and a protocol with dynamic speed negotiation is used	Some terminal concentrators do not support changing the transmission speed (baud rate) dynamically. Check if the connection works without the concentrator
	The advanced system interface board is defective	Check board and replace if necessary
Detailed Protocol Problem		Consult the Data Export Protocol document.

Nurse Call Relay

Symptoms	Cause of Failure	Failure Isolation and Remedy
INOP message Check Nurse Call Relay is issued	Advanced system interface board defective	Replace advanced system interface board
Monitor alarmed, Nurse Call did not activate	Incorrect configuration (Relay latency, Relay trigger)	Check monitor configuration (see configuration guide)
	Connection of cable to monitor or nurse call system not correct	Check cable connection
	Advanced system interface board defective	Replace advanced system interface board
	Standard system interface board is defective	Replace standard system interface board

Flexible Nurse Call Relay

Symptoms	Cause of Failure	Failure Isolation and Remedy
The INOP message Check Nurse Call Relay is issued.	The Flexible Nurse Call Relay I/O board is defective.	Replace the Flexible Nurse Call Relay I/O board.
The monitor alarmed, and the Nurse Call is not activated.	There is an incorrect configuration present (Relay latency, Relay trigger).	Check the monitor configuration (see the Configuration Guide).
	The connection of the cable to the monitor, or the nurse call system is defect.	Check the cable connections.
	The Flexible Nurse Call Relay I/O board is defective.	Replace the Flexible Nurse Call Relay I/O board.

Troubleshooting the ECG OUT

Symptoms	Cause of Failure	Failure Isolation and Remedy
INOP EcgOut Equip Malf is issued	Communication Problem or Power Switch/ECG OUT board defective.	Check that the ECG OUT cable is securely connected and that all MSL connections are properly made. Check that the MSL cable and the MSL connectors are not defective. If the problem persists, replace the Power Switch/ECG OUT board.

Symptoms	Cause of Failure	Failure Isolation and Remedy
No ECG-OUT signal to the Defib		Check the Defib cable and the cable connection from the Power Switch/ECG Out board to the main board. Exchange Power Switch/ECG Out Board if necessary. If problem persists exchange main board.

Image Sticking

If a static image is displayed for a long time on an LCD display, image sticking, i.e. a temporarily retained image, may occur. To eliminate image sticking, switch off the display and switch it back on again. It is also recommended to use the moving image in standby mode.

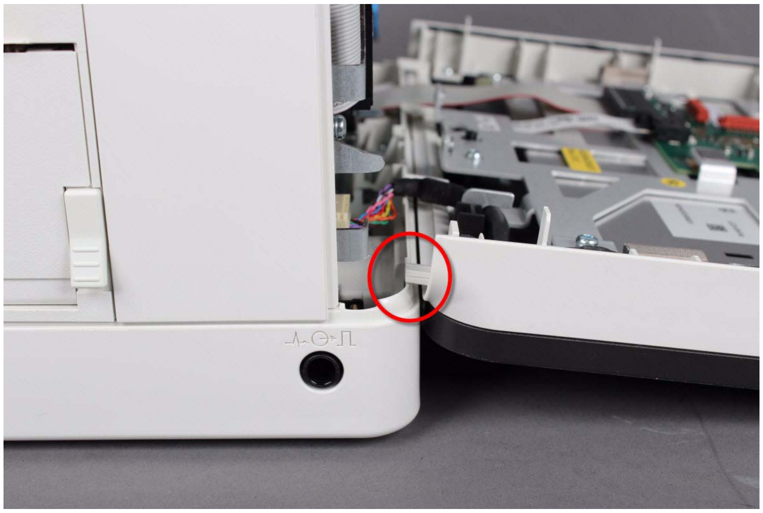
Testing the Functionality of Power Distribution

WARNING

High Voltage - Voltages dangerous to life are present in the instrument when it is connected to the mains power supply.

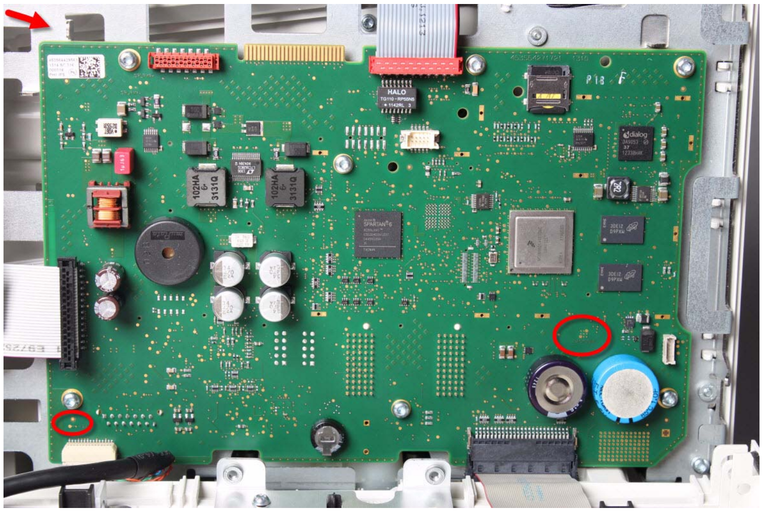
If you are unsure whether the standard interface board or the main board is defective, perform the following tests:

1 Separate the front and back of the monitor, but keep the internal cable connections connected. Place the front sub-assembly latches on top of the bottom housing to ensure that the cable connections are not disconnected or damaged.

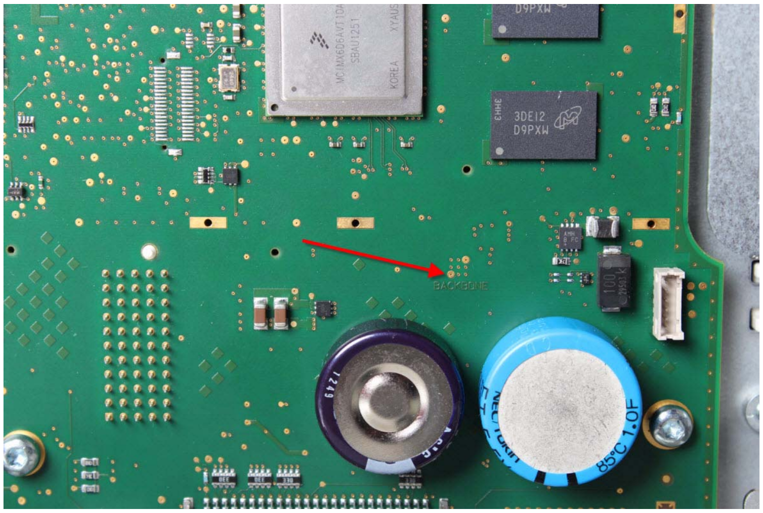


2 Place one multimeter probe on the metal chassis and the other on the following test points (see pictures below).

Overview:

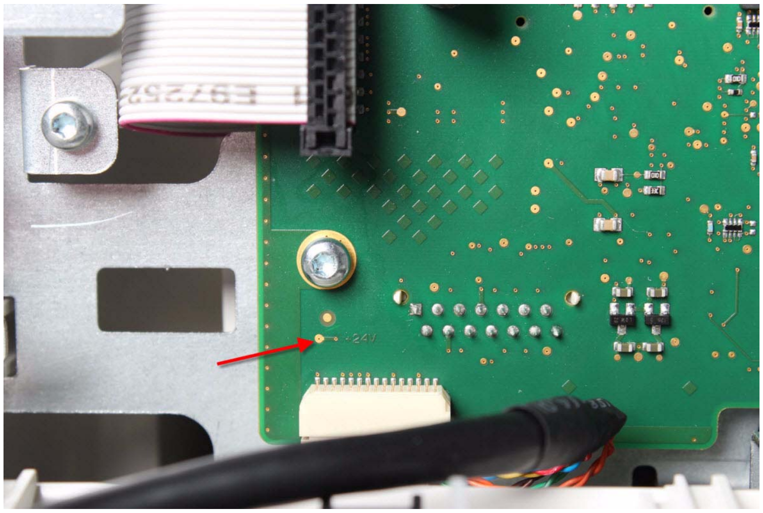


Backbone:



If the monitor is AC powered and switched on, the measured voltage should be 15V (±3%). If this is the case, the power supply and the standard interface board are functioning correctly.

24V:



If the measured voltage is 24V (±5%) the standard interface board is functioning correctly.

Status Log

Many events that occur during start-up or regular monitoring are logged in the Status Log. The Status Log can be printed and cleared. Not all entries in the Status Log are errors.

Monitor				
H	1720	20050	1	4 Apr 02 16:37
C	1721	21050	1	4 Apr 02 15:37

The window title is either **Monitor** or **MeasServ**, dependent on which system component's status log is currently displayed.

The Status Log window shows logged events which caused a reboot of the system component (monitor or measurement server).

The first column in the log identifies the event class ("C": caused a cold start, "H": caused a hot start, "N": no retstart, for information only). Column 3 and 4 identify the event source and event code. Column 4 counts the number of occurrences of the event. The last column shows the time and date of the last occurrence of the event.

The following pop-up keys overlay the SmartKeys:

Clear StatLog	Revision		866060	M3001A

Clear StatLog

This key clears the currently displayed Status Log

Revision

This key switches to the Revision Screen of the currently displayed system component

866060 (MX400), **866062** (MX450), **866064** (MX500), **866066** (MX550)

This key switches to the Monitor Revision Window

M3001A

This key switches to the Multi Measurement Server (MMS) Revision Window

NOTE

- If an event occurs repeatedly, contact your Philips Service Representative.
- It is possible, using the support tool, to download the status log and send it to your Philips Service Representative as a file (for example via e-mail).
- Log files generated by the monitors and measurement modules are used for system troubleshooting and do not contain protected health information.

List of Error Codes

There are no error codes at this point.

Troubleshooting with the Support Tool

Using the support tool you can:

- access the full status log which can be saved as a file
- reload software
- identify defective devices
- reset touch screen calibration

For details on how to perform these tasks see the Support Tool User Manual.

Troubleshooting the Individual Measurements or Applications

For problems isolated to an individual parameter or application such as event review, please consult the Instructions for Use and configuration information.

If the instructions for use did not resolve an individual parameter problem, then another module or measurement server should be tried.

If you are getting questionable readings for individual measurements you may want to do the Performance Verification tests in the *Testing and Maintenance* section.

The performance of the individual applications (event review, arrhythmia, trending) are affected by the configuration of the monitor. When contacting Philips support you may be asked about the configuration of the monitor to aid in troubleshooting.

5

Repair and Disassembly

The following section describes the disassembly and reassembly procedures for the monitor and its components to the extent required to remove and replace faulty assemblies. Do not further disassemble the product past the point described in these procedures.

WARNING

High Voltage - Voltages dangerous to life are present in the instrument. Do not perform any disassembly or reassembly procedures (other than MMS, MMS extension or parameter module removal) with power applied to the instrument. Failure to adhere to this warning could cause serious injury or death.

Before doing any disassembly, turn power off, disconnect the Local Distribution Cable, **AC power cable**, MSL cable, Defib sync' cable and RS232 cable (where appropriate), disconnect the MMS.

Tools Required

- Torx screwdrivers (T10, T20)
- Torque wrench
- 1 small flat head screwdriver
- Needle Nose Pliers
- ESD mat and wrist strap

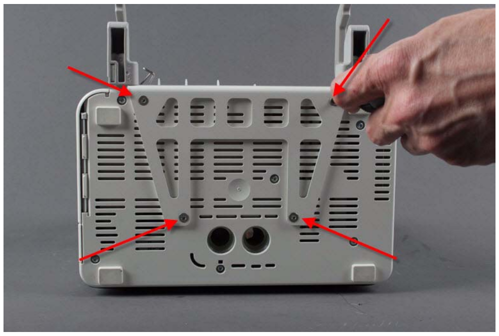
Monitor Disassembly

NOTE

- The reassembly procedures are the reverse procedures of the disassembly procedures unless otherwise noted.
- Your monitor may look slightly different than on the pictures in this chapter, depending on the model and options ordered.

Removing the Bedhanger

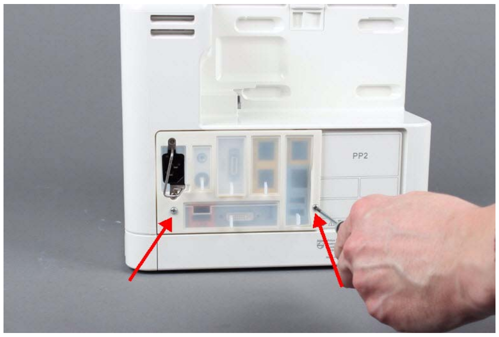
1 Remove the four screws securing the bedhanger from the bottom housing and remove the bedhanger.



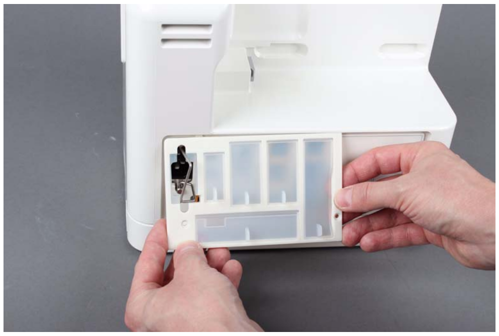
2 When reinstalling the bedhanger, do not use the same screws, because their locking varnish will have been damaged. Use a new set of screws.

Removing the Spillage Cover

1 Remove the two screws securing the spillage cover.

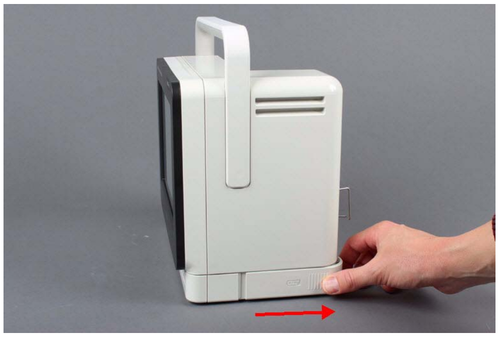


2 Remove the spillage cover by lifting it upwards.

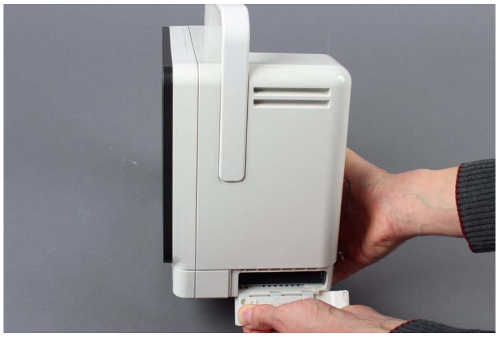


Removing the Battery Compartment Door

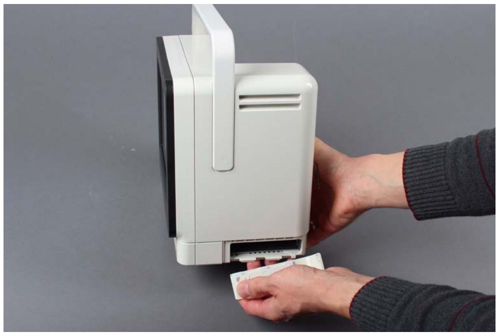
1 Slide the battery compartment door towards the rear of the monitor to open it.



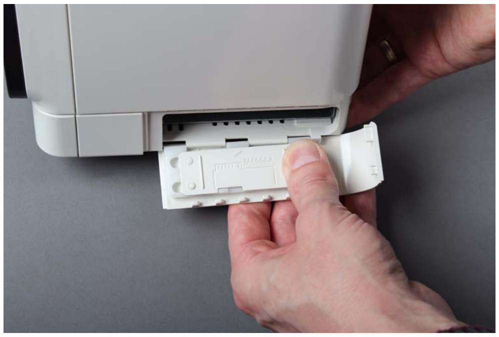
2 Open the battery door all the way and apply a slight pressure to the hinges.

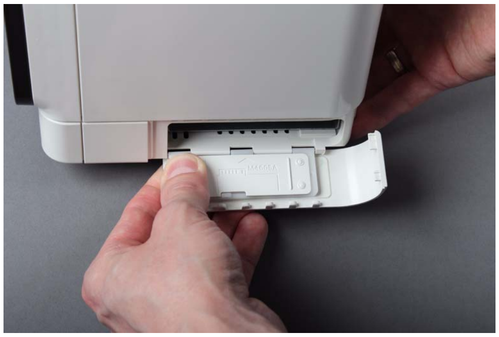


3 Pull off the battery door.



4 To reassemble the battery door, attach it to the outer hinge first, and then snap the other hinges into place.



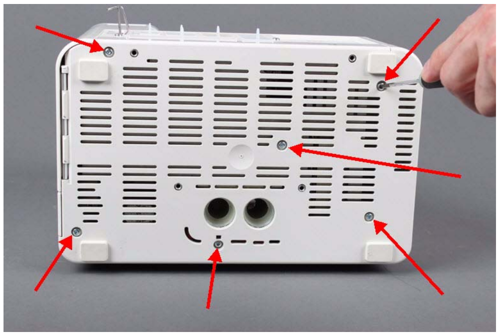


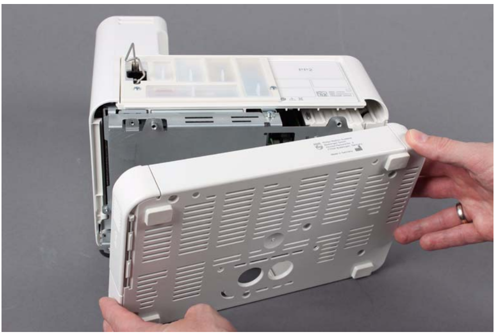
5 Check that the battery door opens and closes properly, to ensure that it has been reassembled correctly.

Removing the Bottom Housing

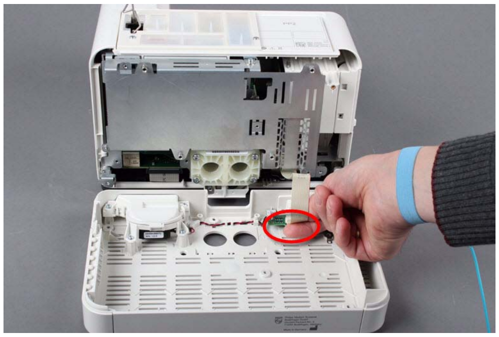
1 Remove the battery from the monitor.

2 Remove the six screws and pull off the bottom housing.





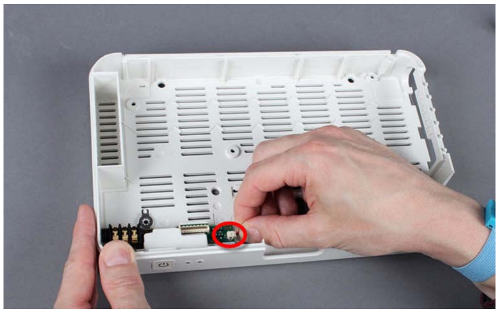
3 Disconnect the cable connecting the power switch/ECG Sync Out board to the main board.



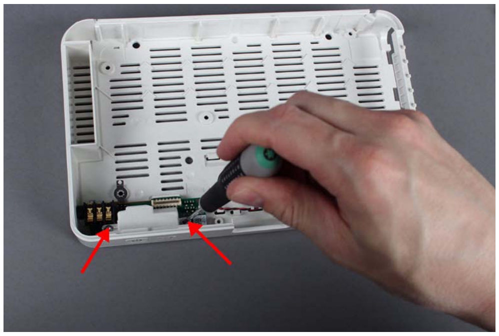
Removing the Power Switch/ECG Sync Out Board and Power Button

1 Remove the bottom housing as described in “Removing the Bottom Housing” on page 142.

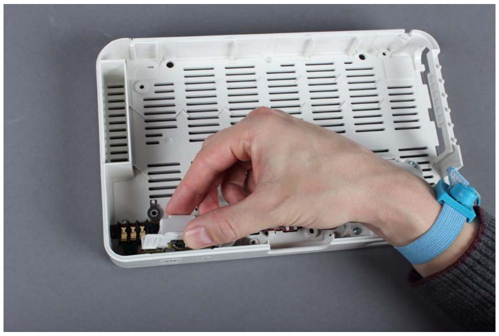
2 Unplug the speaker cable from the Power Switch/ECG Sync Out board.



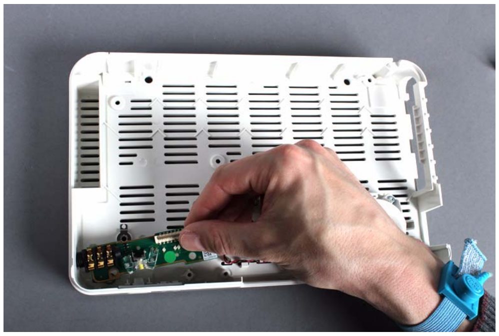
3 Remove the two screws.



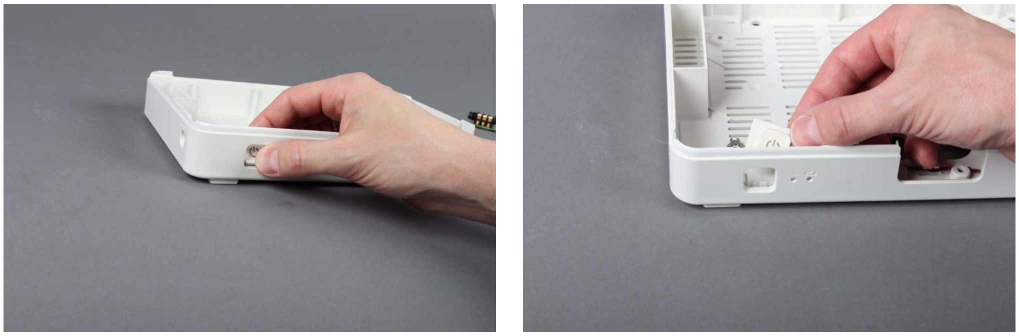
4 Remove the tappet guide.



5 Remove the power switch/ECG Sync Out board.



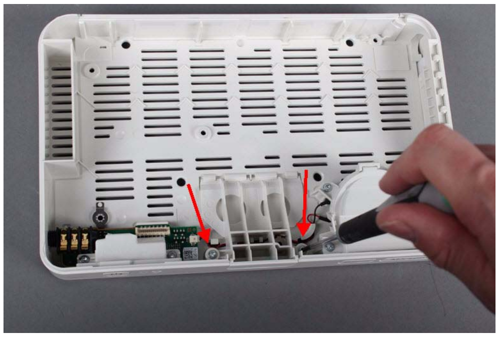
6 Push the power button in to remove it.

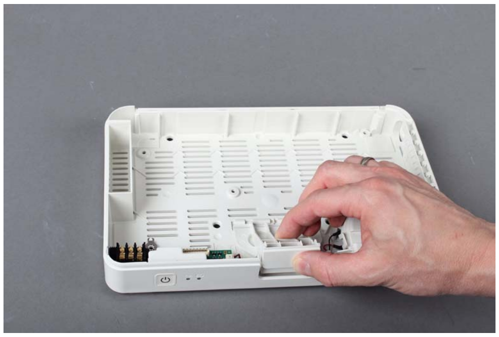


Removing the Loudspeaker

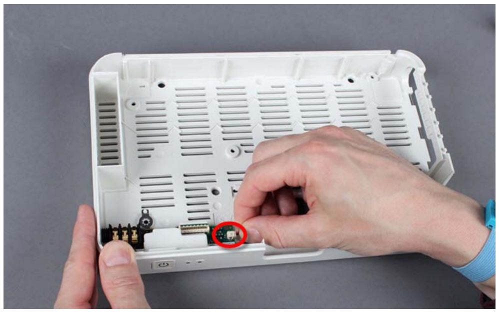
1 Remove the bottom housing as described in “Removing the Bottom Housing” on page 142.

2 If no quick mount is installed, you will have to remove the blank cover first. To do this, remove the two screws and pull out the blank cover.

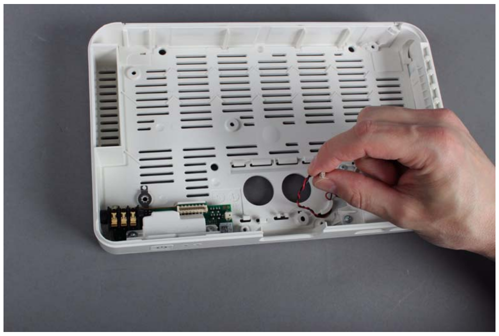




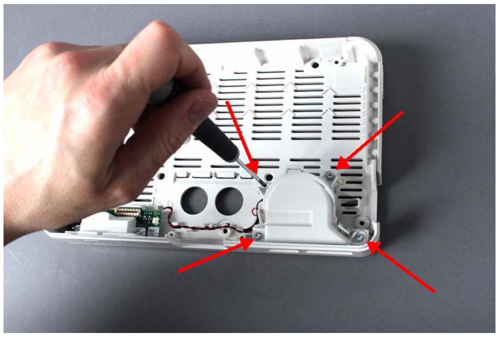
3 Disconnect the speaker cable from the power switch/ECG Sync Out board.



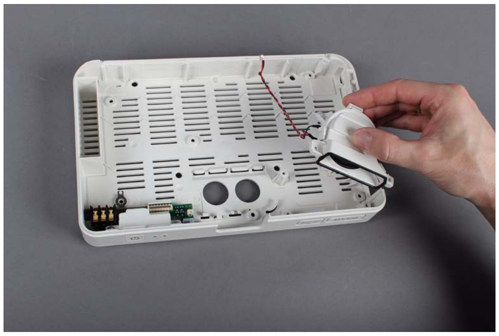
4 Remove the speaker cable from its guiding clasps.



5 Remove the four screws from the loudspeaker housing.

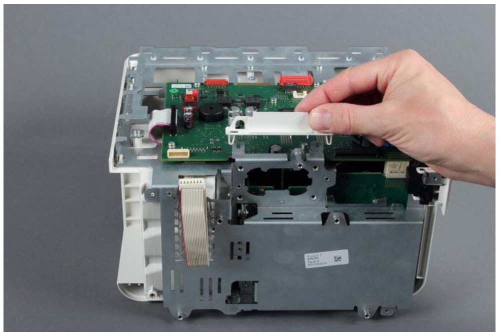


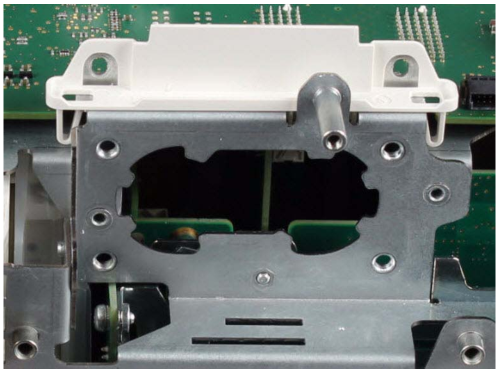
6 Remove the loudspeaker.



Replacing the Ingress Protection Clamp

In order to replace the ingress protection clamp, snap the white ingress protection clamp on to the metal chassis as shown below.

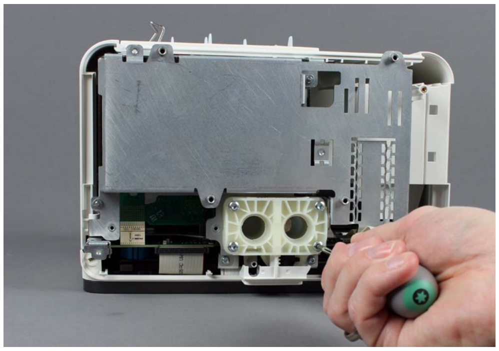




Removing the Quick Mount

1 Remove the bottom housing as described in the section “Removing the Bottom Housing” on page 142.

2 Remove the four screws from the quick mount.

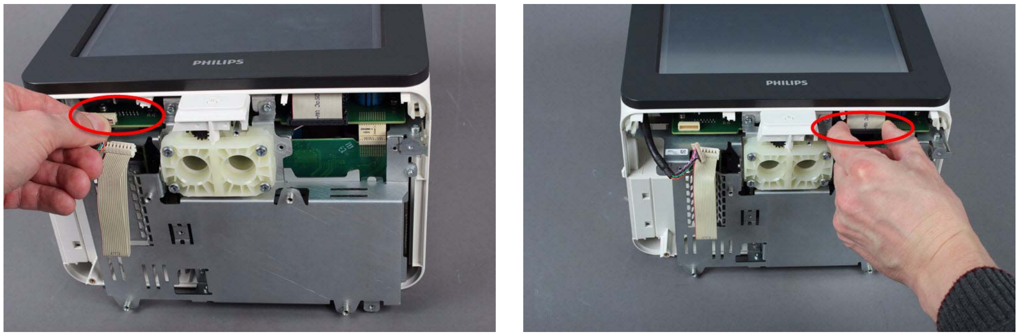


3 Remove the quick mount.

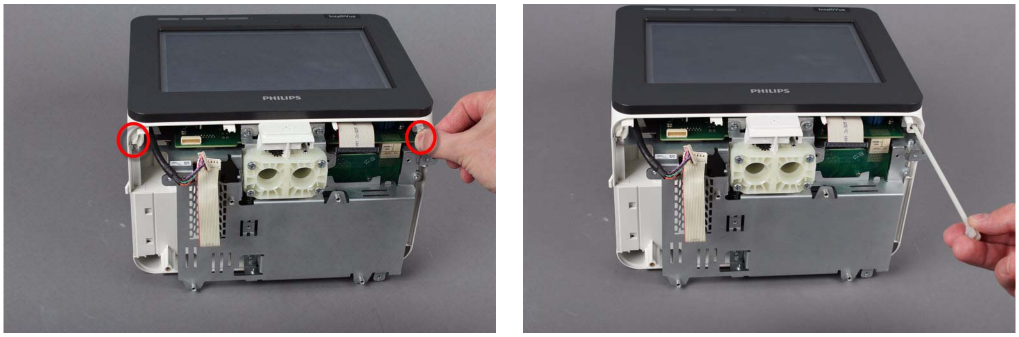
Separating the Front and Back of the Monitor

1 Remove the bottom housing as described in “Removing the Bottom Housing” on page 142.

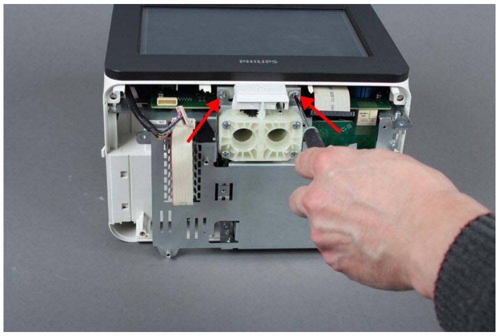
2 Disconnect the two cables as shown below.



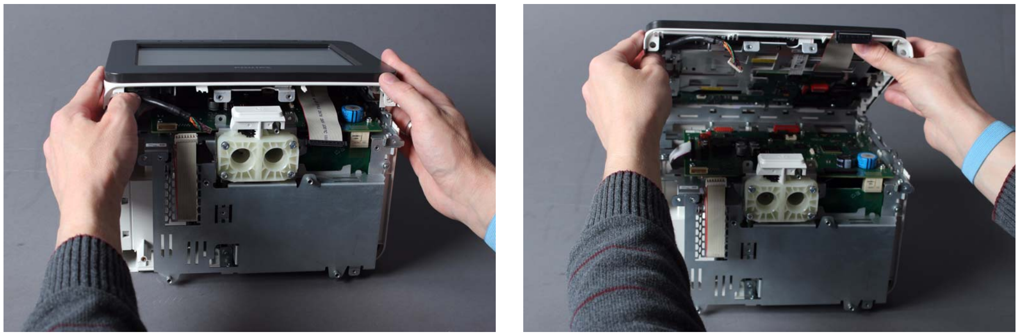
3 Remove the two pins.



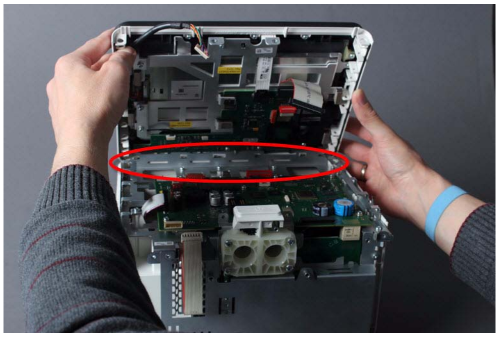
4 Remove the two screws as shown below.



5 Lift off the front from the back of the monitor.



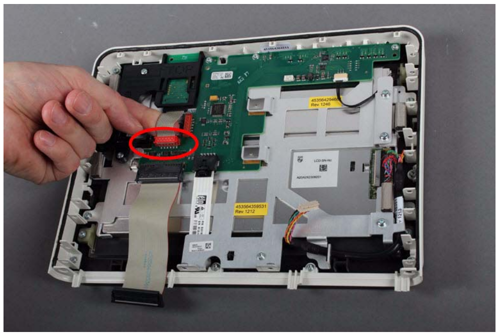
6 Reassemble the monitor by performing the above steps in reverse order. When reattaching the front to the back, the front must be positioned such that the latches snap into place.



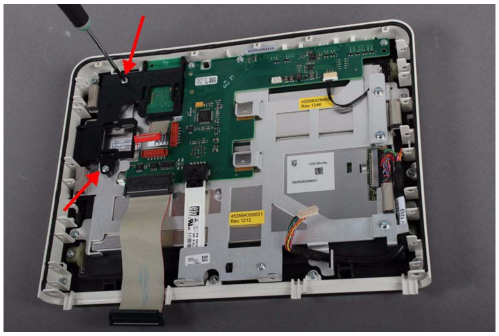
Removing the Short Range Radio Board(s) (MX400)

1 Separate the front and back of the monitor as described in the section “Separating the Front and Back of the Monitor” on page 146.

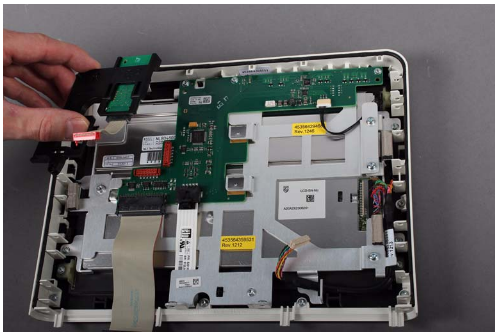
2 Disconnect the Short Range Radio connector(s) from the panel adapter board



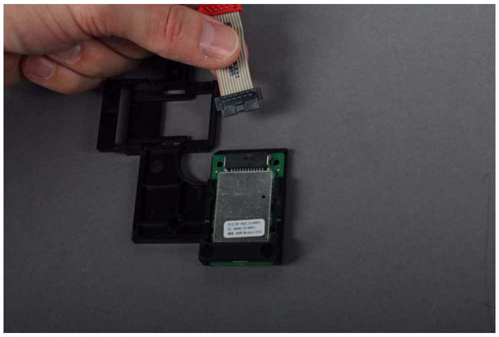
3 Remove the two screws from the Short Range Radio board holder.



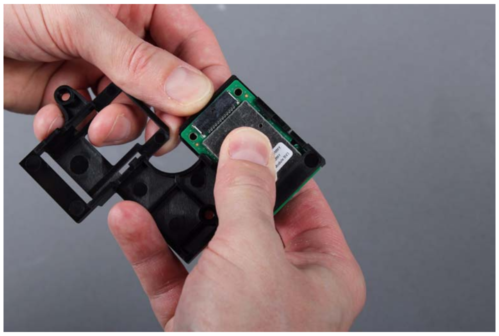
4 Lift out the Short Range Radio board holder with the Short Range Radio board(s).

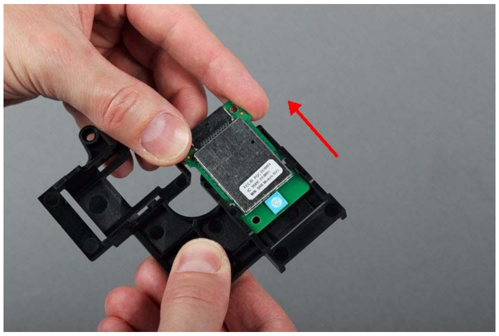


5 Disconnect the cable(s) from the Short Range Radio board(s).



6 Press against the holder with your thumb to release the Short Range Radio board(s) and then pull out the board(s).





7 Reassemble the monitor by performing the above steps in reverse order.

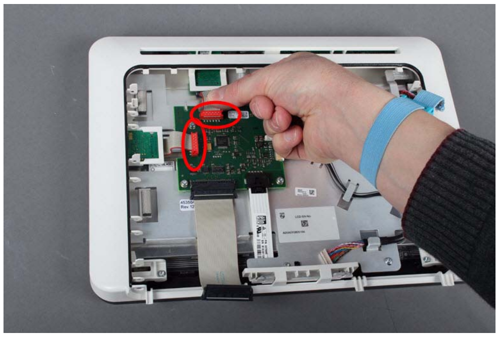
NOTE

When replacing the Short Range Radio board(s), the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

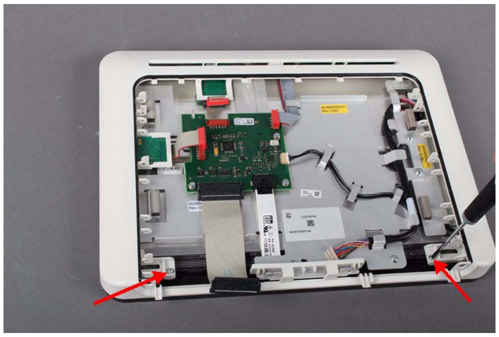
Removing the Short Range Radio Board(s) (MX450/MX500)

1 Separate the front and back of the monitor as described in the section “Separating the Front and Back of the Monitor” on page 146.

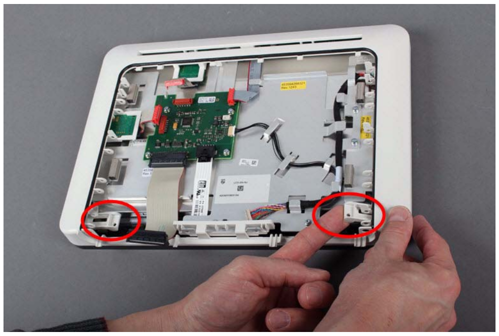
2 Disconnect the Short Range Radio connector(s) from the panel adapter board.



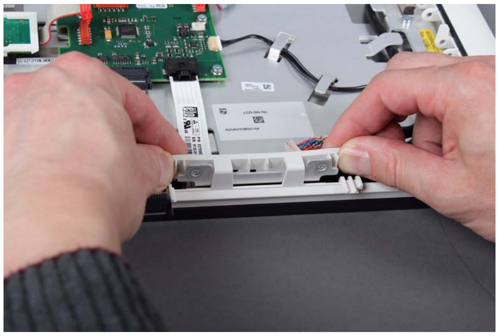
3 Remove the screws from the two clamps holding the display housing frame.

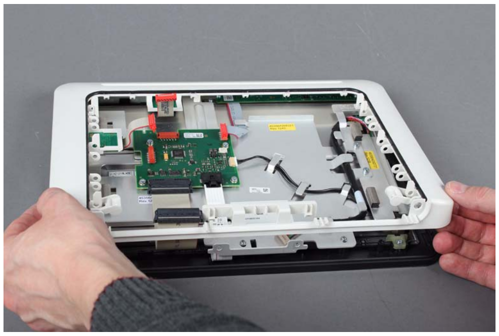


4 Release the two clamps by pushing them upwards.

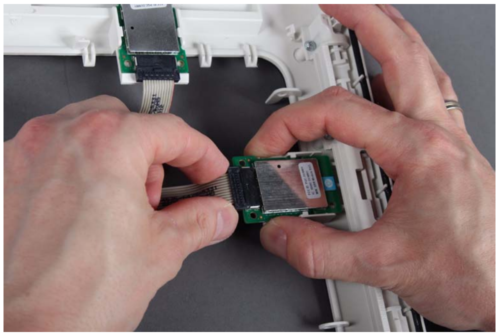


5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.





6 The Short Range Radio board(s) are located in the display frame. Disconnect the cable(s) from the Short Range Radio board(s), press down the latch in the frame holding the board(s) and pull out the board(s)



7 Reassemble the monitor by performing the above steps in reverse order.

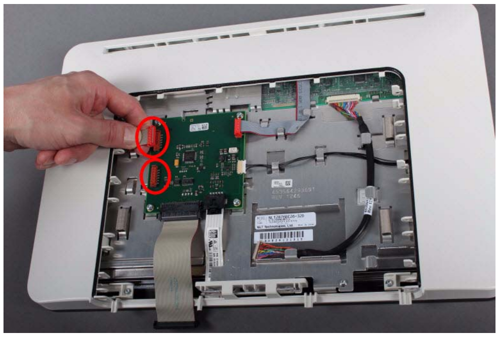
NOTE

When replacing the Short Range Radio board(s), the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

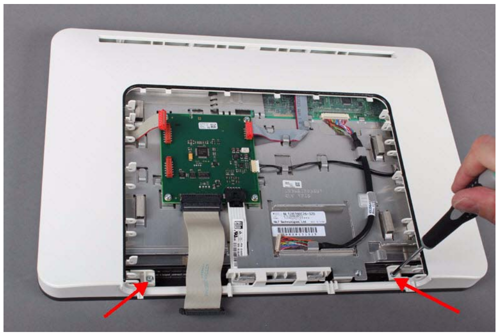
Removing the Short Range Radio Board(s) (MX550)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

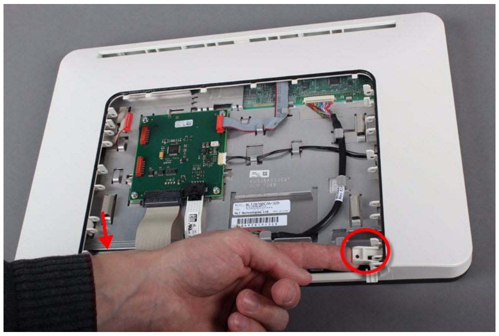
2 Disconnect the Short Range Radio connector(s) from the panel adapter board.



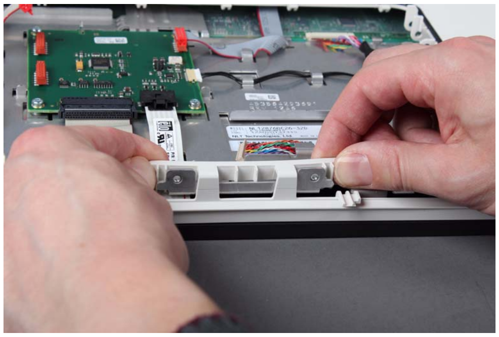
3 Remove the screws from the two clamps holding the display housing frame.

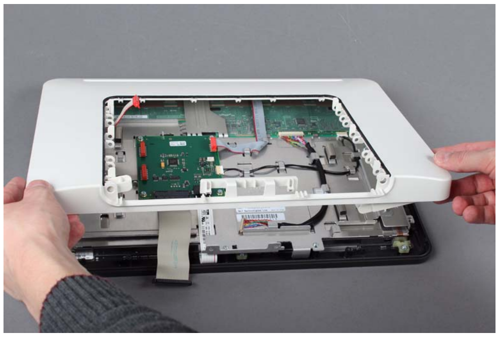


4 Release the two clamps by pushing them upwards.

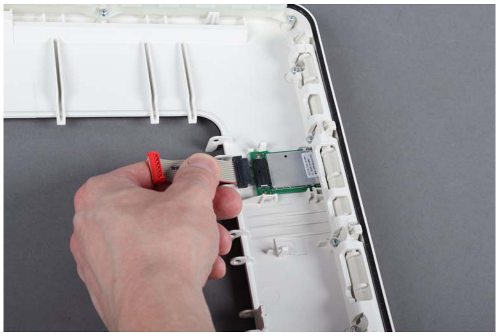


5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.

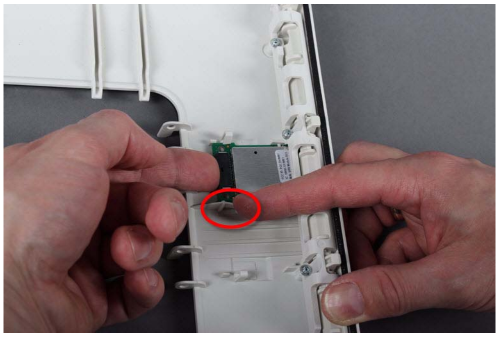


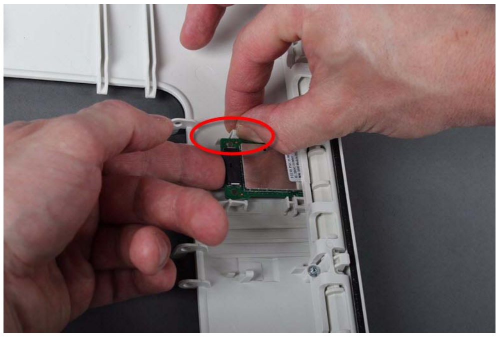


6 Disconnect the cable(s) from the Short Range Radio board(s). The Short Range Radio board(s) are located in the display frame.



7 Release the latches holding the SRR board one after the other by pushing them away from the board and releasing the board form underneath them.





8 Pull out the SRR board.

9 Reassemble the monitor by performing the above steps in reverse order.

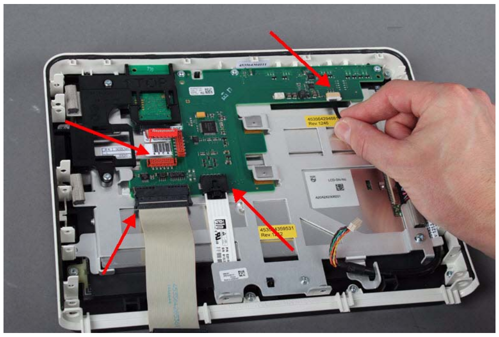
NOTE

When replacing the Short Range Radio board(s), the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

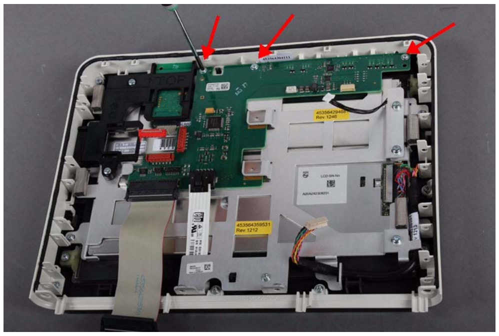
Removing the Panel Adapter Board (MX400)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

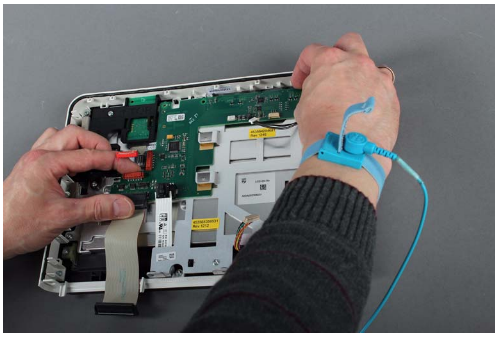
2 Disconnect all cables from the panel adapter board (the number of cables depends on the options installed).

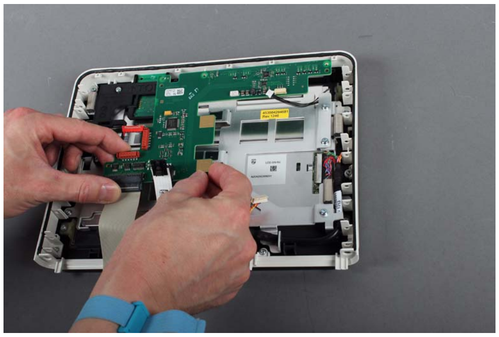


3 Remove the three screws from the panel adapter board.

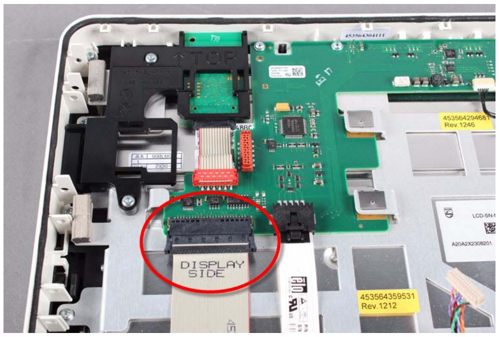


4 Slide the panel adapter board downwards towards you to release it from the latches and lift out the board.





5 Reassemble the monitor by performing the above steps in reverse order. When reconnecting the cables to the panel adapter board, make sure that the main board cable is connected with the connector marked "DISPLAY SIDE" to the panel adapter board as shown below.



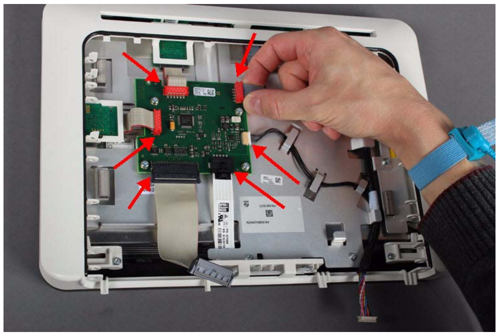
NOTE

When replacing the panel adapter board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

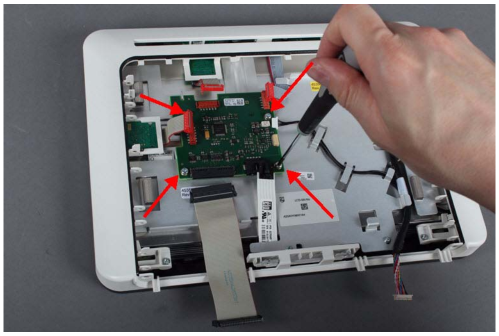
Removing the Panel Adapter Board (MX450/MX500)

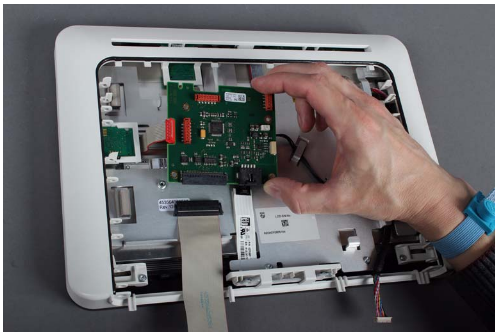
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Disconnect all cables from the panel adapter board (the number of cables depends on the options installed).

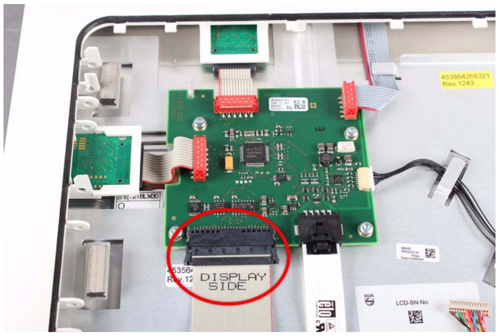


3 Remove the four screws from the panel adapter board and remove the board.





4 Reassemble the monitor by performing the above steps in reverse order. When reconnecting the cables to the panel adapter board, make sure that the main board cable is connected with the connector marked "DISPLAY SIDE" to the panel adapter board as shown below.



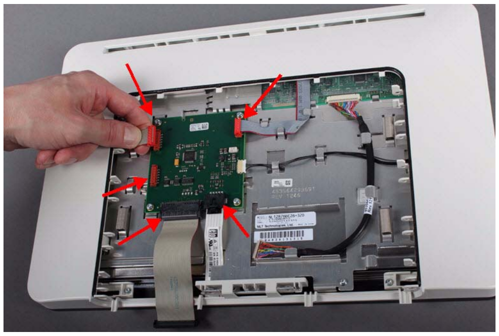
NOTE

When replacing the panel adapter board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

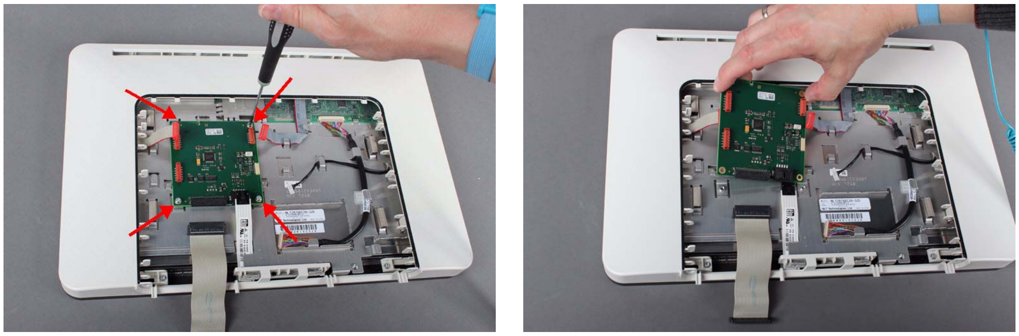
Removing the Panel Adapter Board (MX550)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

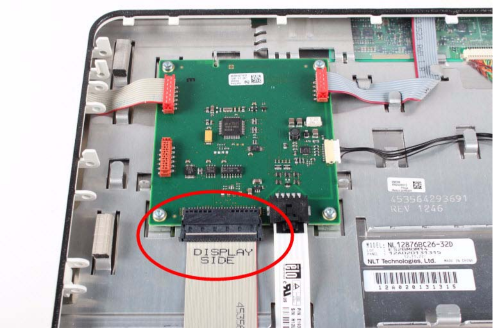
2 Disconnect all cables from the panel adapter board (the number of cables depends on the options installed).



3 Remove the four screws from the panel adapter board and remove the board.



4 Reassemble the monitor by performing the above steps in reverse order. When reconnecting the cables to the panel adapter board, make sure that the main board cable is connected with the connector marked "DISPLAY SIDE" to the panel adapter board as shown below.



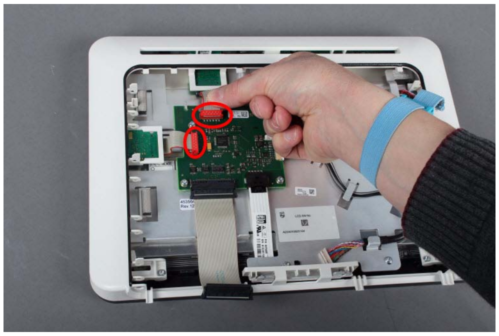
NOTE

When replacing the panel adapter board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

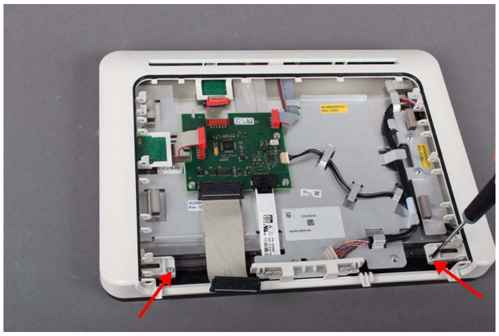
Removing the Alarm LED Board (MX450/MX500)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

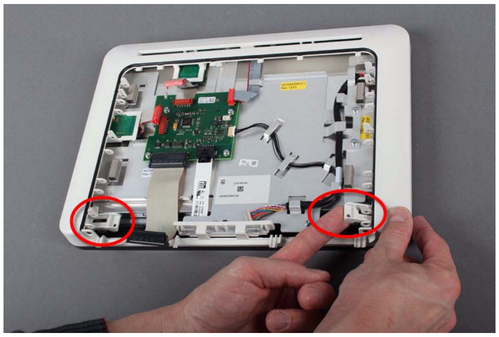
2 If Short Range Radio boards are installed, disconnect the Short range Radio connector(s) from the panel adapter board.



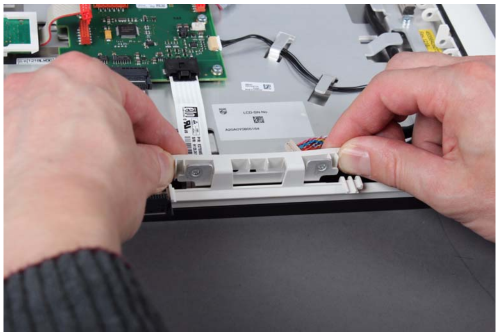
3 Remove the screws from the two clamps holding the display housing frame.

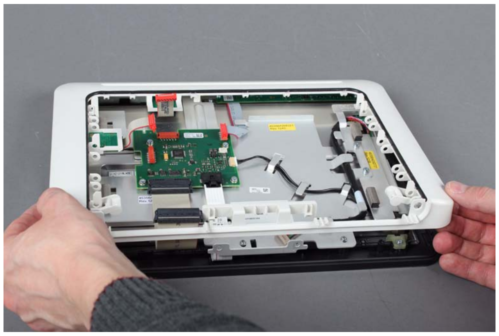


4 Release the two clamps by pushing them upwards.

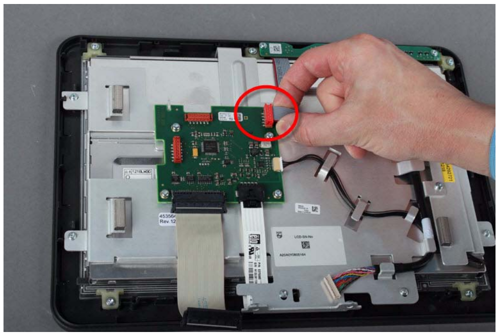


5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.

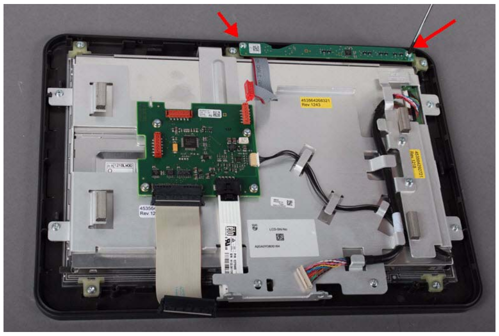




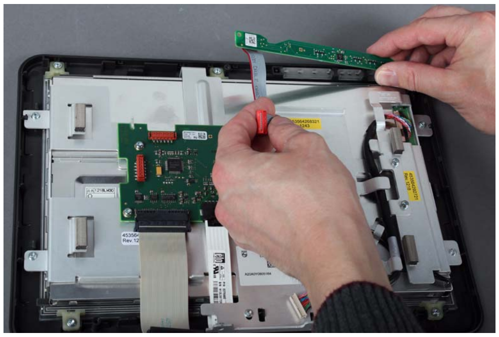
6 Disconnect the Alarm LED connector from the panel adapter board.



7 Remove the two screws from the Alarm LED board.



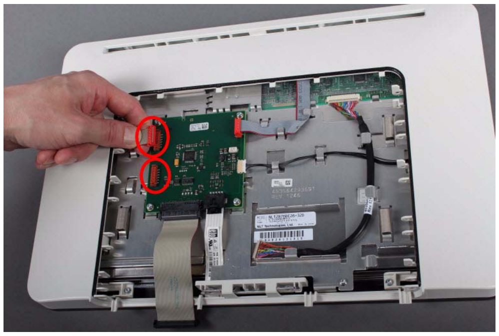
8 Remove the Alarm LED board.



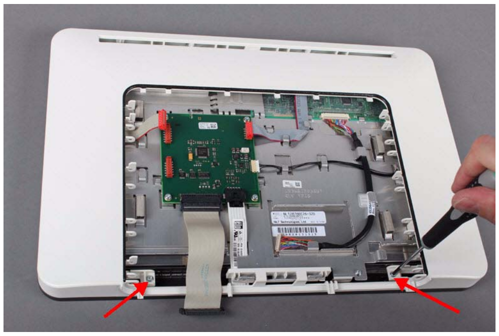
Removing the Alarm LED Board (MX550)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

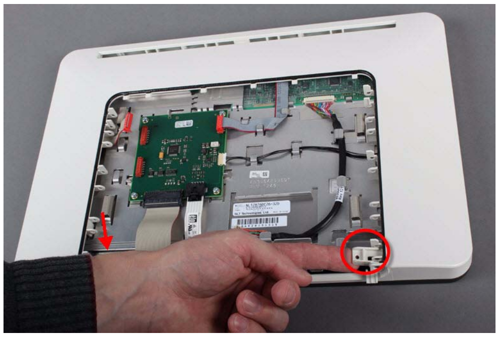
2 If Short Range Radio boards are installed, disconnect the Short Range Radio connector(s) from the panel adapter board.



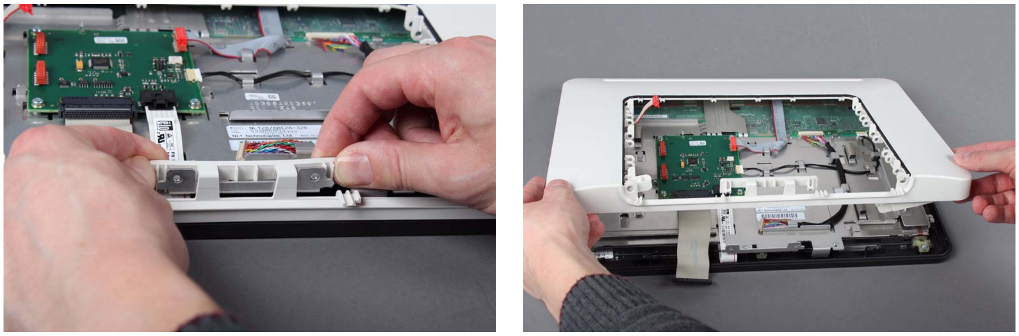
3 Remove the screws from the two clamps holding the display housing frame.



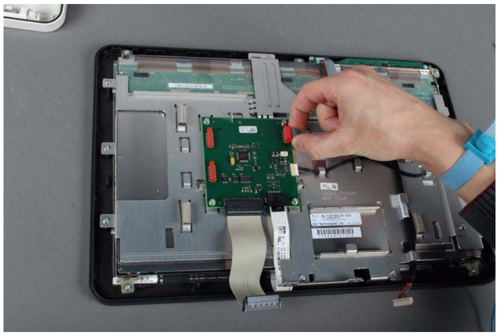
4 Release the two clamps by pushing them upwards.



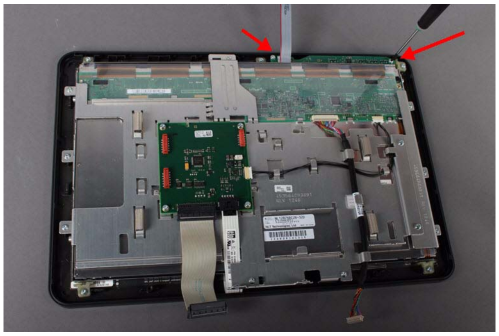
5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.



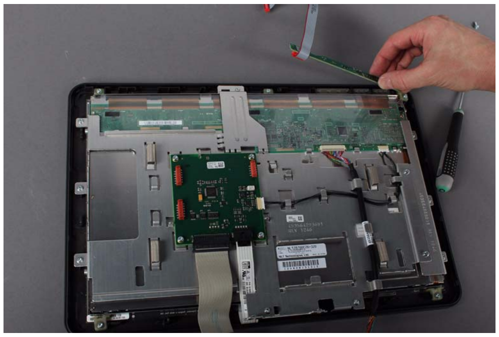
6 Disconnect the Alarm LED connector from the panel adapter board.



7 Remove the two screws from the Alarm LED board.



8 Remove the Alarm LED board.



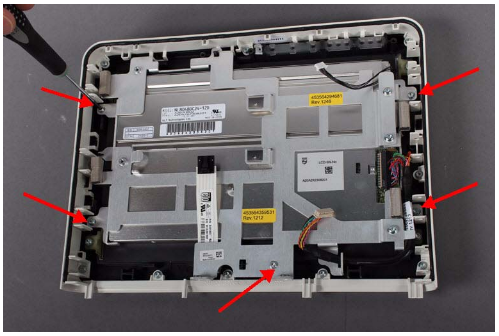
Removing the LCD Panel (MX400)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

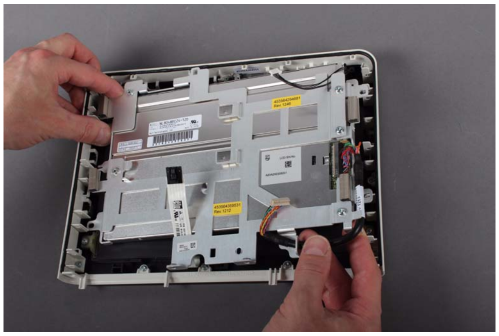
2 Remove the Short Range Radio Board(s) as described in “Removing the Short Range Radio Board(s) (MX400)” on page 147.

3 Remove the Panel Adapter Board as described in “Removing the Panel Adapter Board (MX400)” on page 152.

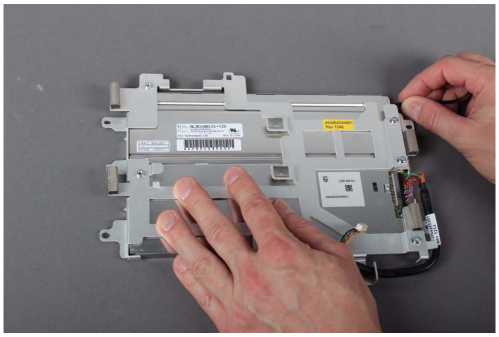
4 Remove the five screws from the LCD panel chassis.

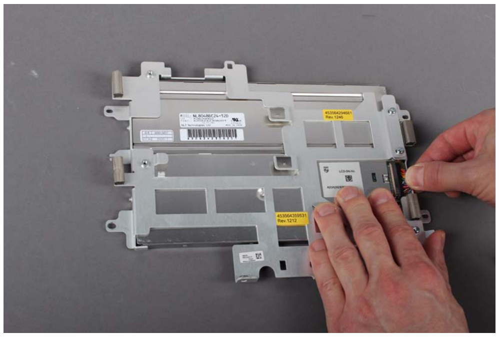


5 Lift out the LCD panel.



6 Unplug and remove the remaining two cables from the LCD panel so they can be used with the exchange panel.



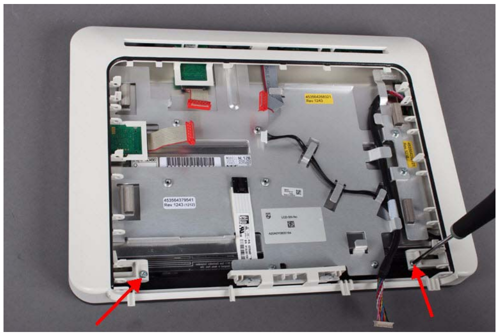


Removing the LCD Panel (MX450/MX500)

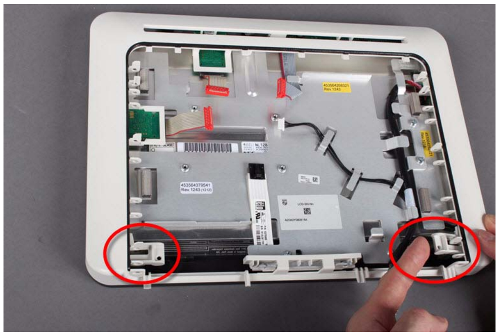
1 Separate the front and back of the monitor as described in the section “Separating the Front and Back of the Monitor” on page 146.

2 Remove the Panel Adapter Board as described in “Removing the Panel Adapter Board (MX450/ MX500)” on page 153.

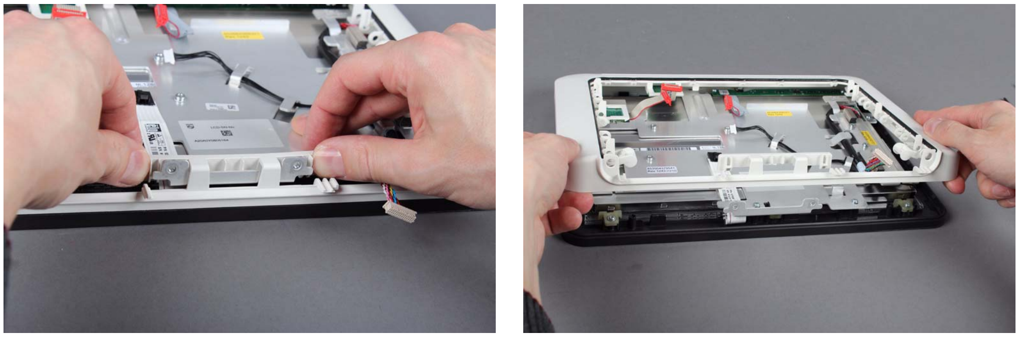
3 Remove the screws from the two clamps holding the display housing frame.



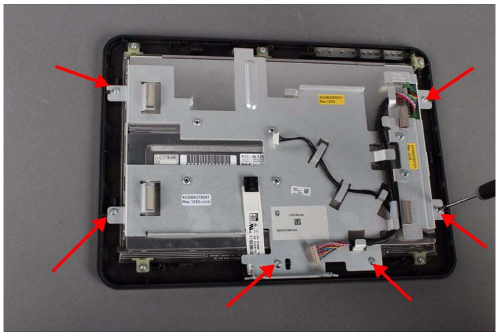
4 Release the two clamps by pushing them upwards.



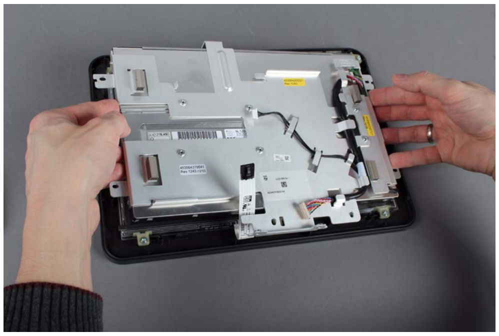
5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.



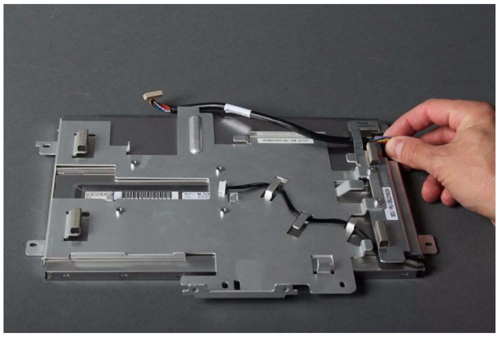
6 Remove the six screws from the back of the LCD Panel.

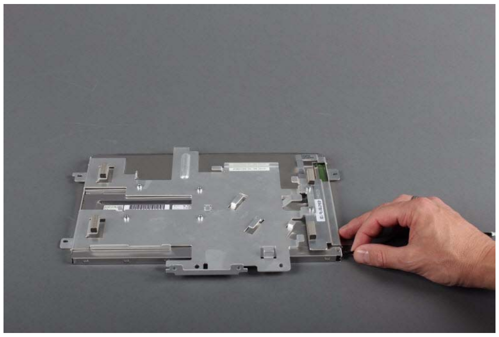


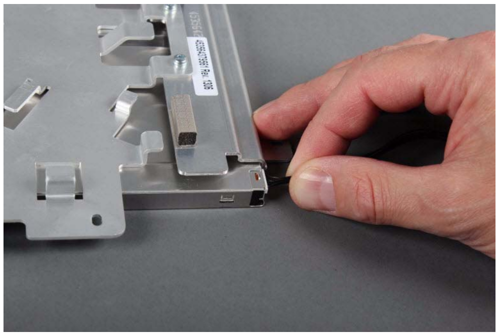
7 Lift out the LCD Panel.



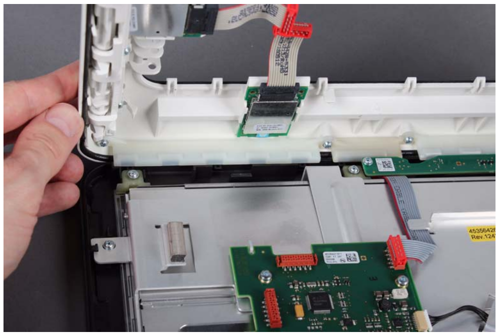
8 Unplug and remove the two remaining cables from the LCD Panel so they can be used with the exchange panel.

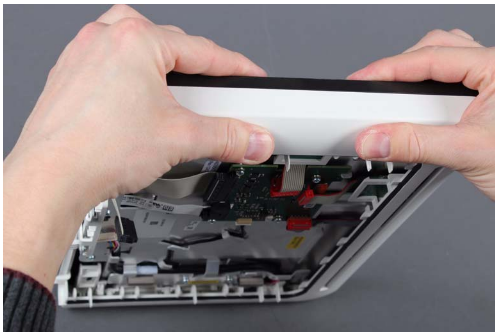






9 Reassemble the front of the monitor by performing the above steps in reverse order. When reinserting the frame, position it at a right angle so it correctly clicks into the housing. Press the frame and the housing together on all sides after reassembly to make sure that it is seated correctly.

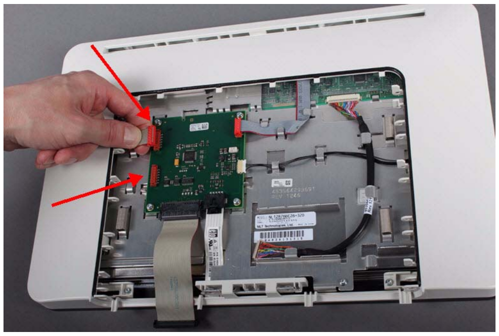




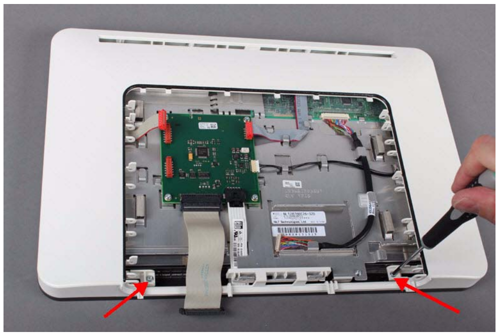
Removing the LCD Panel (MX550)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

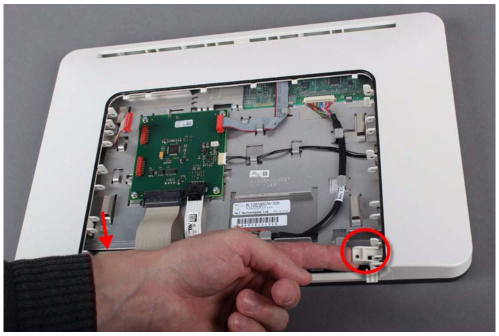
2 If Short Range Radio boards are installed, disconnect the Short Range Radio connector(s) from the panel adapter board.



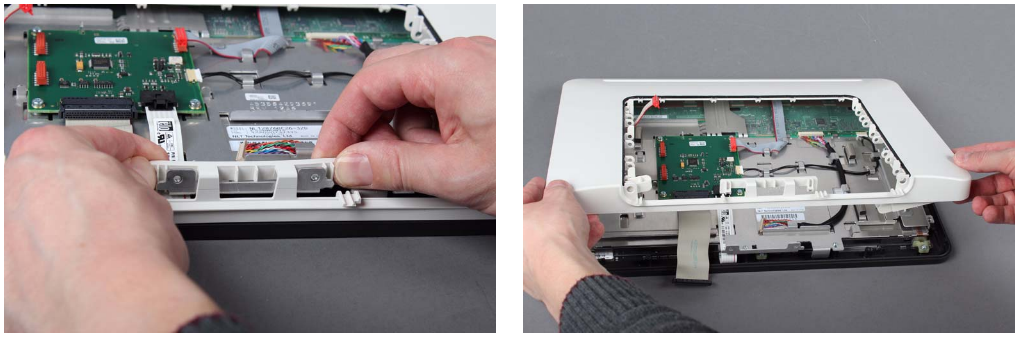
3 Remove the screws from the two clamps holding the display housing frame.



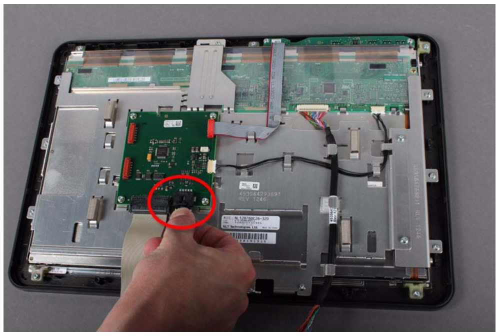
4 Release the two clamps by pushing them upwards.

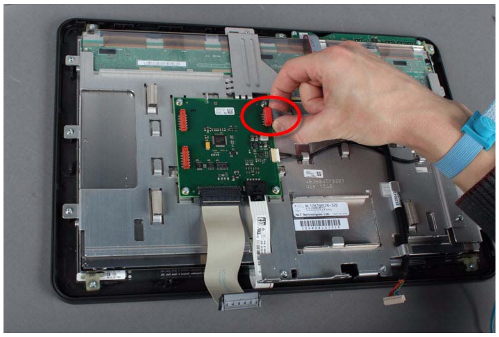


5 Release the latch at the bottom of the frame by pushing it forwards, then lift up the frame.

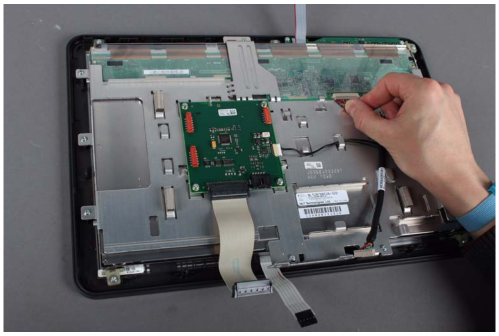


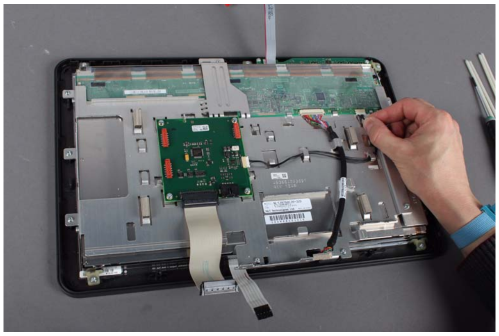
6 Remove the touch connector and the Alarm LED connector from the panel adapter board.



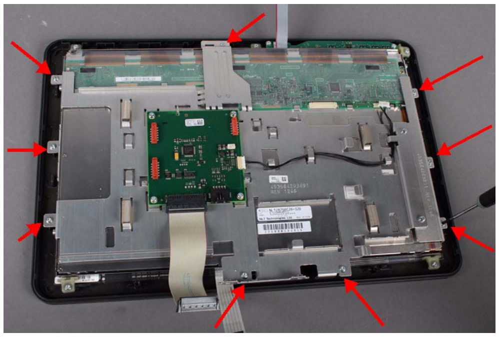


7 Remove the video cable and the backlight cable.

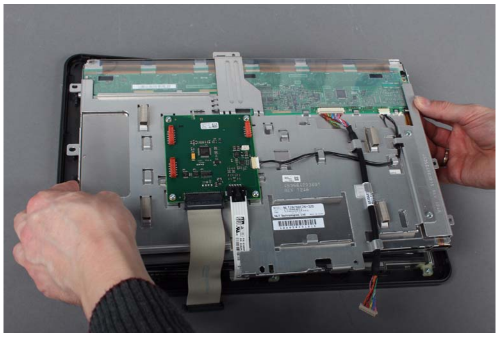




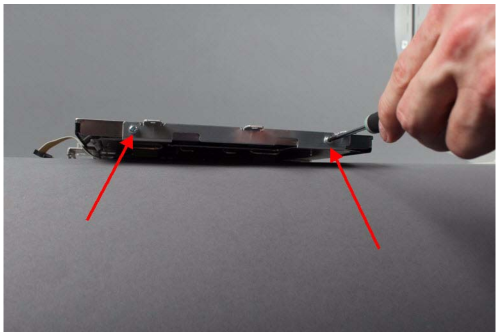
8 Remove the nine screws from the back of the LCD Panel.



9 Lift out the LCD Panel.



10 Remove the two screws on each side of the LCD panel chassis.



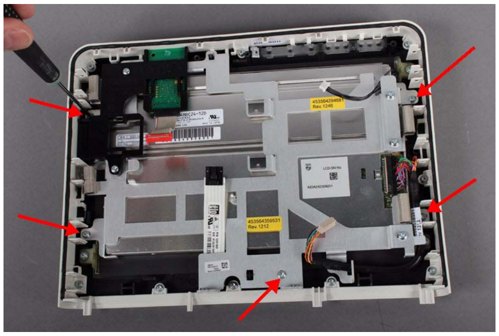
11 Separate the LCD panel from its chassis.

Removing the Touch Bezel (MX400)

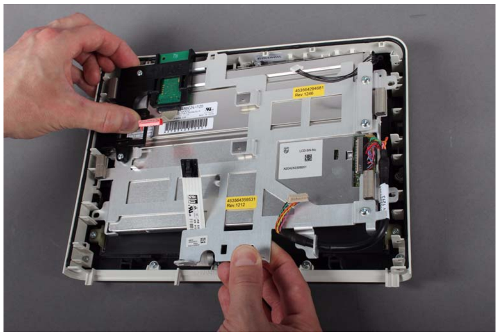
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

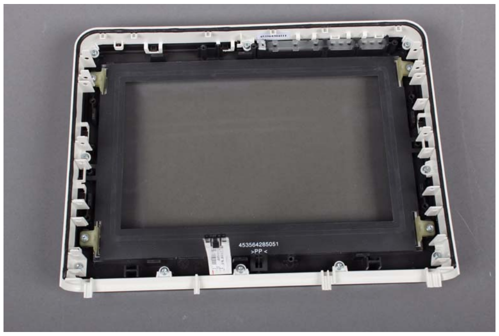
2 Remove the Panel Adapter Board as described in “Removing the Panel Adapter Board (MX400)” on page 152.

3 Remove the five screws from the LCD Panel chassis.



4 Lift out the LCD panel.



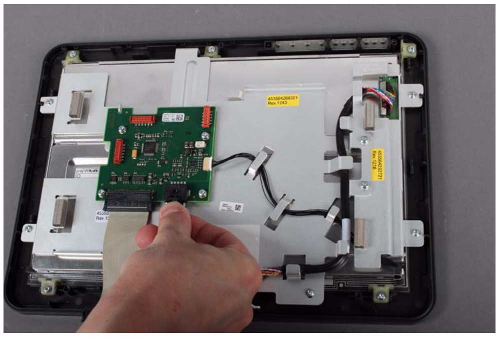


Removing the Touch Bezel (MX450/MX500)

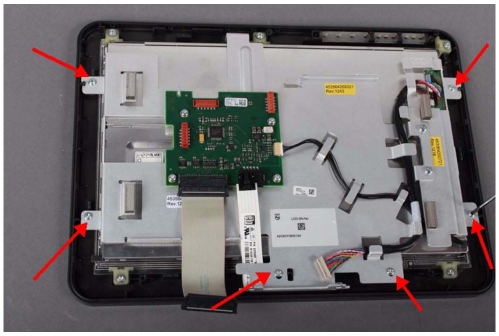
1 Separate the front and back of the monitor as described in the section “Separating the Front and Back of the Monitor” on page 146.

2 Remove the Alarm LED board as described in “Removing the Alarm LED Board (MX550)” on page 157.

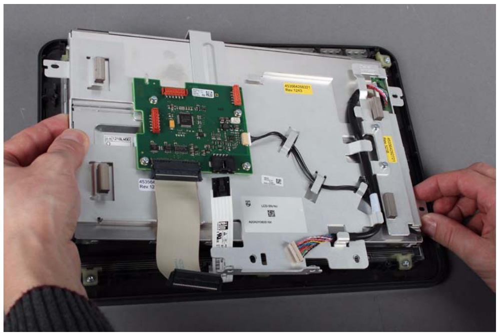
3 Disconnect the touch connector from the panel adapter board.



4 Remove the six screws from the back of the LCD Panel.



5 Lift out the LCD Panel.

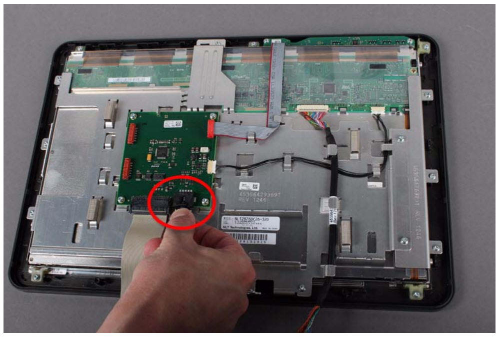


Removing the Touch Bezel (MX550)

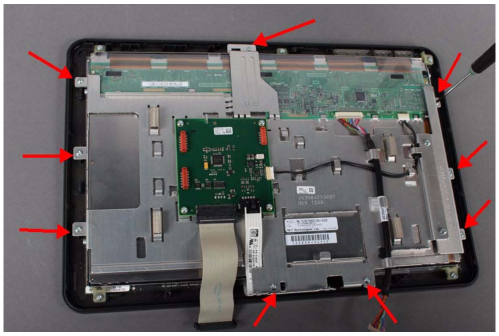
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the Alarm LED board as described in “Removing the Alarm LED Board (MX550)” on page 157.

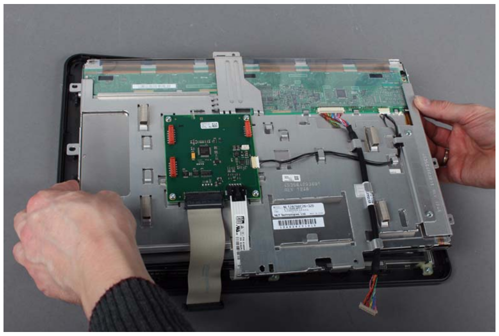
3 Disconnect the touch connector from the panel adapter board.



4 Remove the nine screws from the back of the LCD Panel.

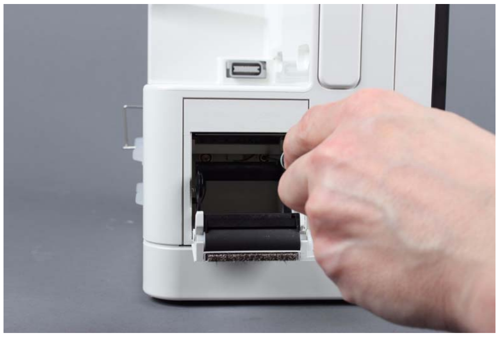


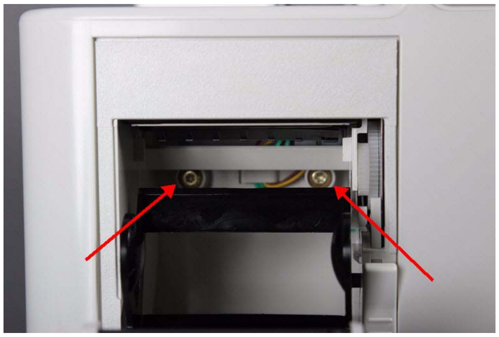
5 Lift out the LCD Panel.



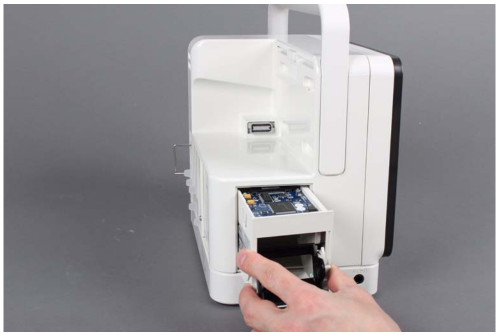
Removing the Internal Recorder (MX400/450)

1 Loosen the two screws inside the recorder.





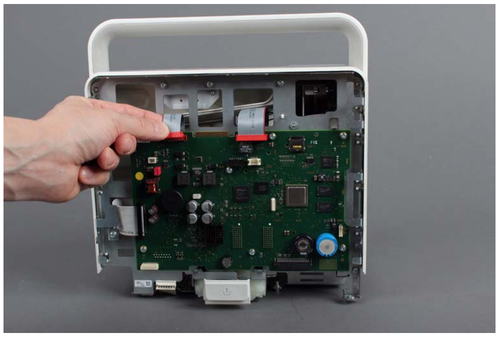
2 Pull out the internal recorder.



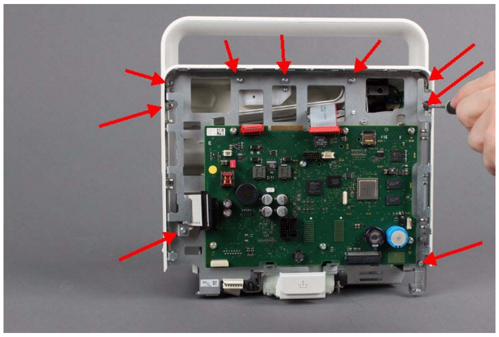
Removing the Rear Housing

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

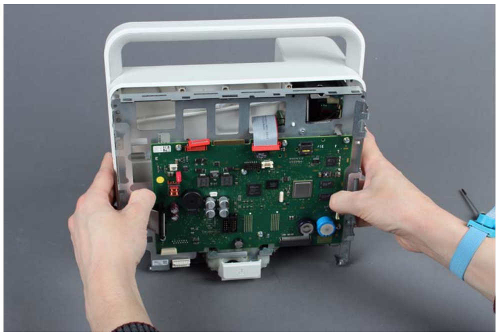
2 Disconnect all cables from the main board.

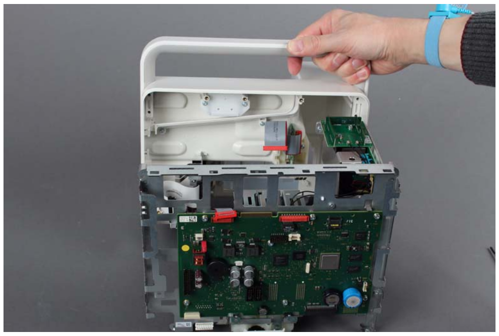


3 Remove the nine screws from the metal chassis.



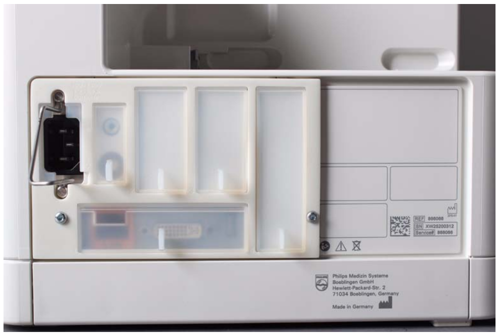
4 Pull the chassis out of the rear housing.

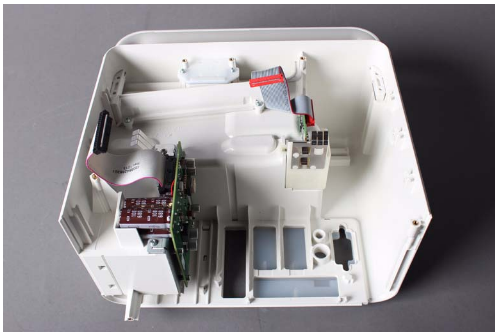




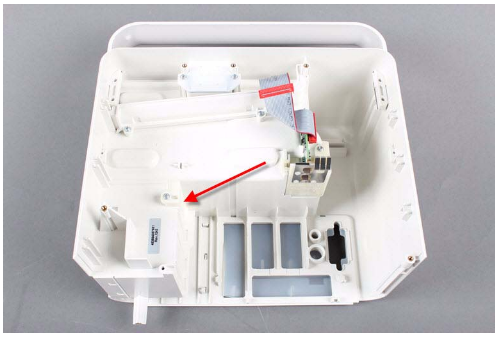
Replacing the Rear Housing

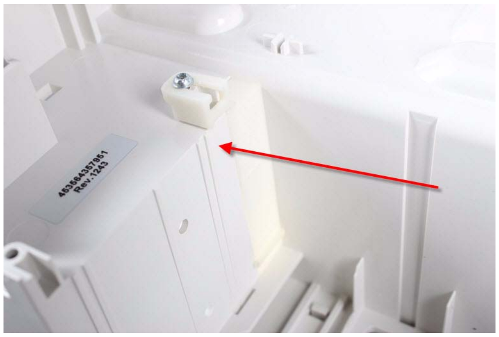
When replacing the rear housing, make sure the regulatory plate, spillage cover, any blank covers for the I/O slots, the MSL connector and the recorder incl. recorder board from the old rear housing are reused.





For MX400/450 monitors without recorder, ensure that the internal blank cover from the old rear housing is reused.





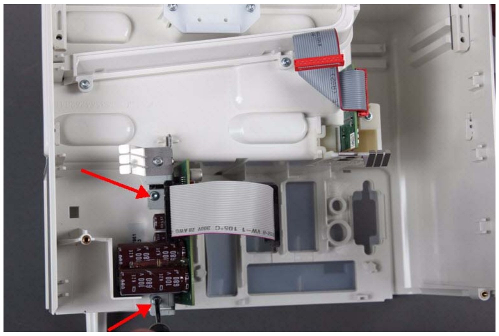
Removing the Recorder Board (MX400/450)

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

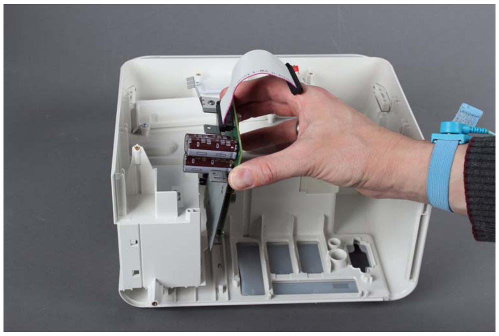
2 Remove the Recorder as described in “Removing the Internal Recorder (MX400/450)” on page 168.

3 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

4 Remove the two screws securing the recorder board assembly.



5 Pull out the recorder board assembly.

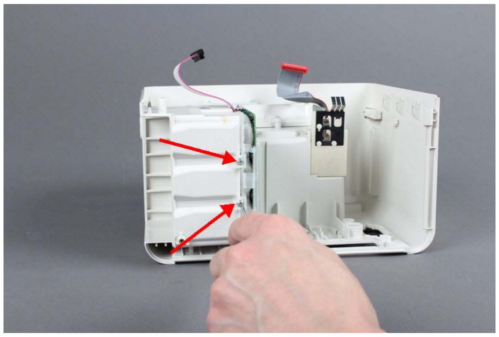


Removing the Internal Module Rack Board (MX500/MX550)

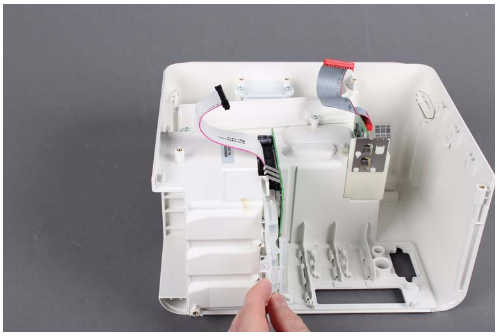
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

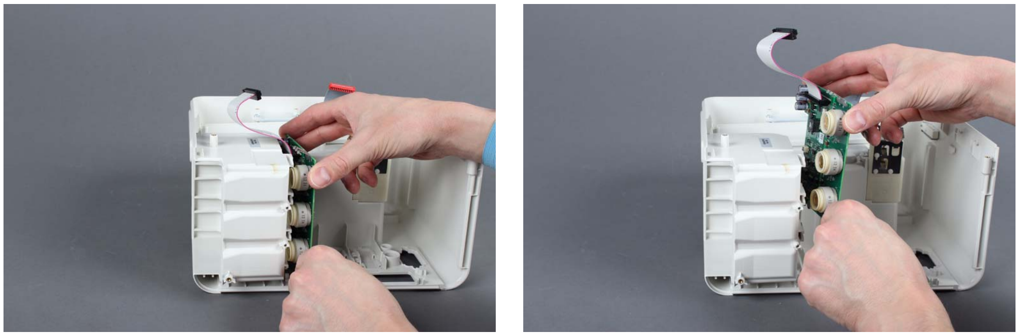
3 Remove the two screws at the bottom of the internal module rack.



4 Pull out the plastic holder.



5 Carefully disconnect the rack board and pull it out.



6 Reassemble the monitor by performing the above steps in reverse order.

NOTE

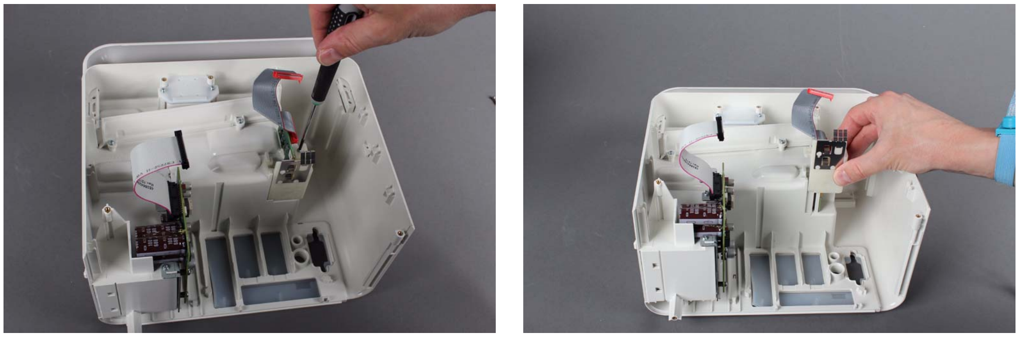
When replacing the rack board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

Removing the MSL Board

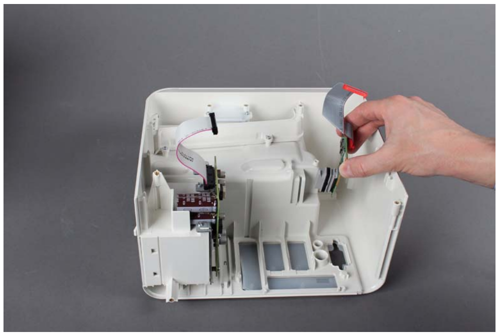
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 Remove the screw securing the MSL board holder and pull out the holder.



4 Pull out the MSL board

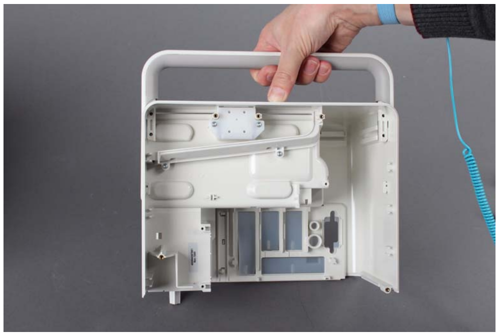


Removing the Handle

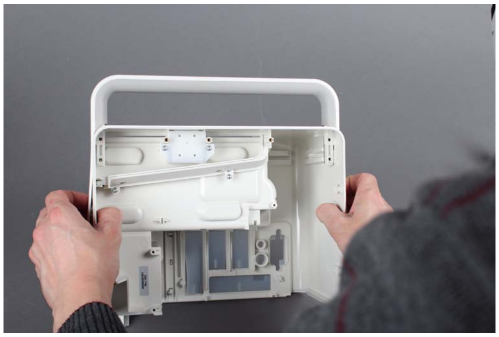
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

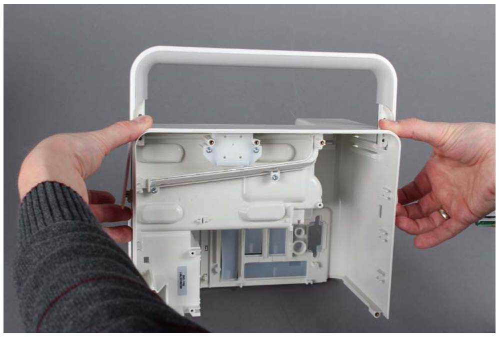
2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 Pull the handle upwards.

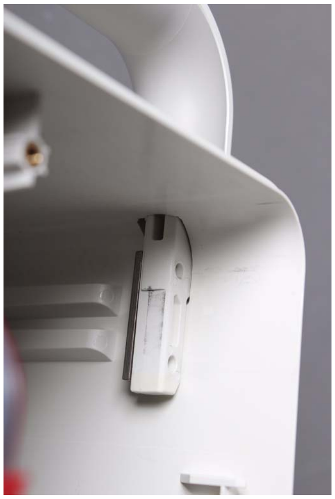


4 Press the latches of the handle outwards and then pull the lower ends of the handle away from the housing to remove it completely.



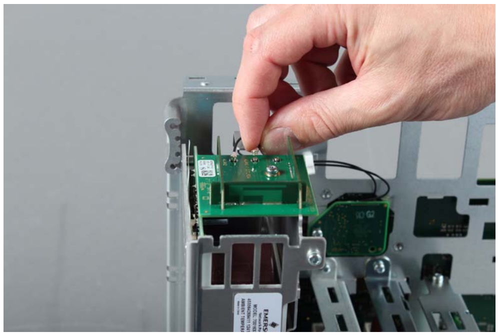


5 Before reinserting the new handle, make sure the metal threads of the handle are pointing towards the back of the rear housing.

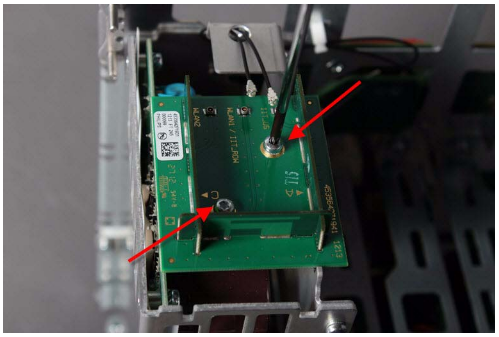


Removing the Antenna Board

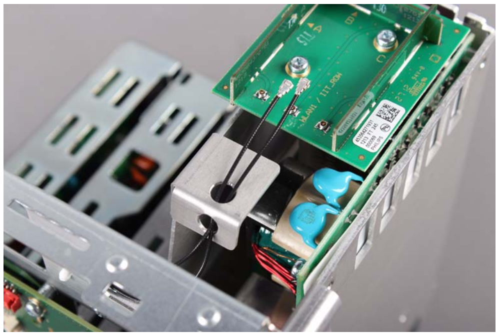
1. Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.
2. Remove the rear housing as described in “Removing the Rear Housing” on page 169.
3. Disconnect all antenna cables from the antenna board.



4. Remove the two screws securing the antenna board and pull out the board.



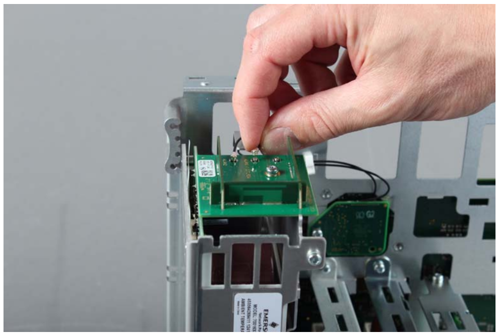
5. Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cables to the antenna board, make sure to pull them through both guidance holes in the metal sheet.



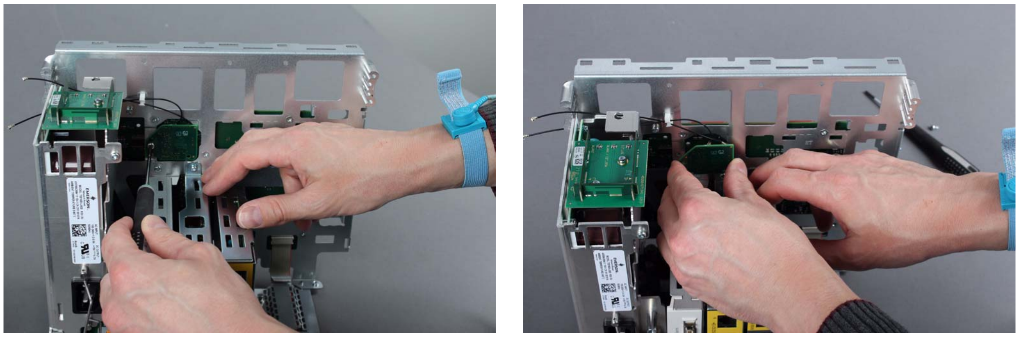
Removing the WLAN board

1. Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.
2. Remove the rear housing as described in “Removing the Rear Housing” on page 169.

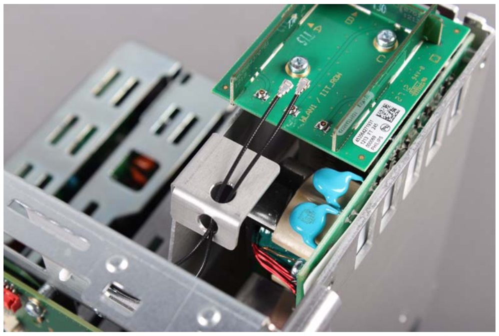
3 Disconnect the WLAN antenna cables from the antenna board.



4 Remove the screw securing the WLAN board and pull out the board.



5 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cables to the antenna board, make sure to pull them through both guidance holes in the metal sheet.



NOTE

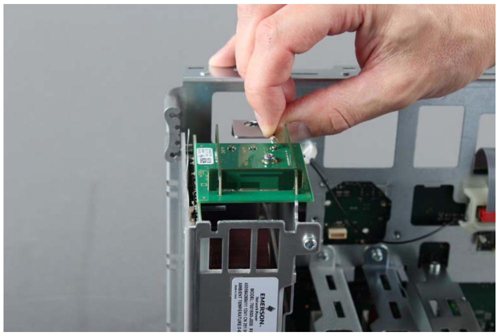
When replacing the WLAN board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

Removing the IIT Board

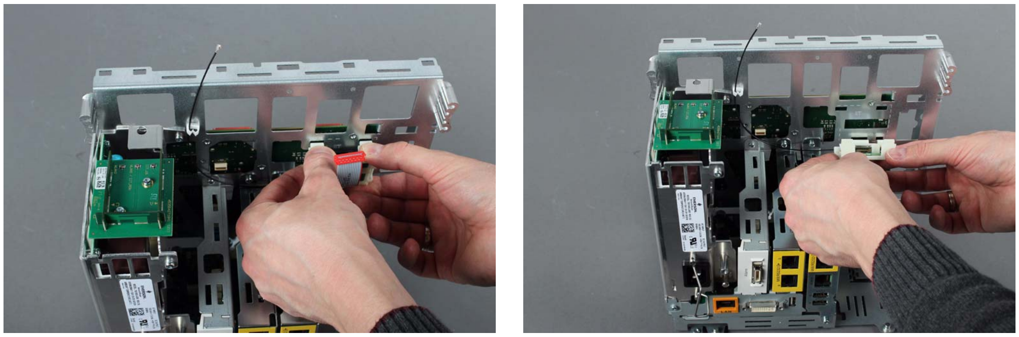
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

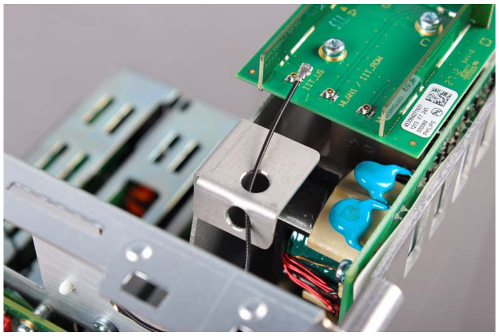
3 Disconnect the IIT antenna cable from the antenna board.



4 Press the IIT board holder together to release it from the chassis and then pull it out.



5 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cable to the antenna board, make sure to pull it through both guidance holes in the metal sheet. Connect the IIT antenna cable according to the IIT bandwidth used (1.4 GHz to IIT_US connector, 2.4 GHz to WLAN1/IIT_ROW connector).



NOTE

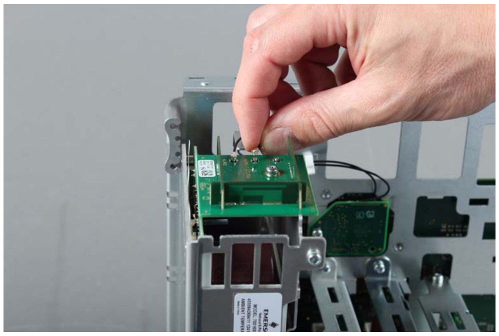
When replacing the IIT board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

Removing the Power Supply

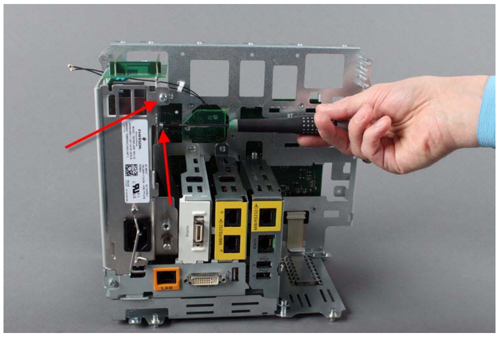
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

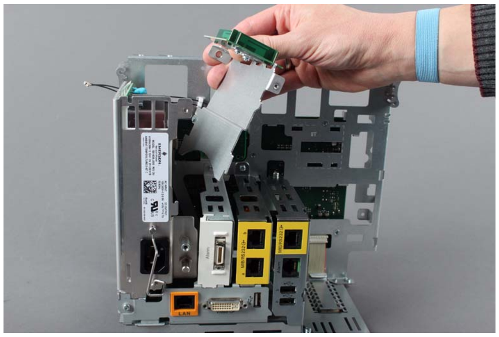
2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 If a WLAN or IIT board is installed, disconnect the antenna cables from the antenna board.

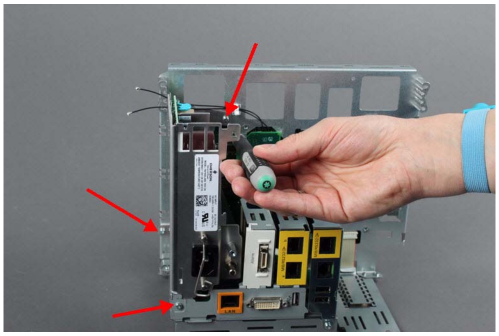


4 Remove the two screws securing the antenna assembly and remove the assembly.

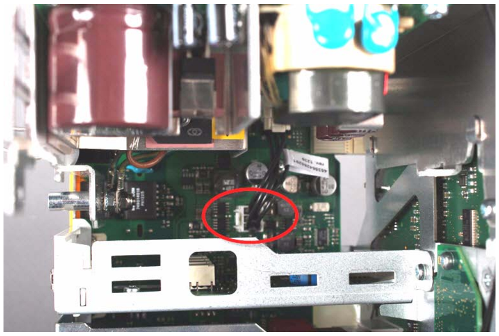




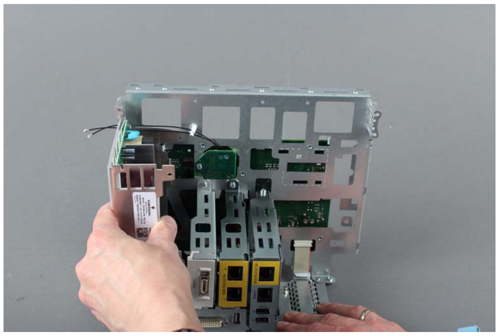
5 Remove the three screws from the power supply chassis.

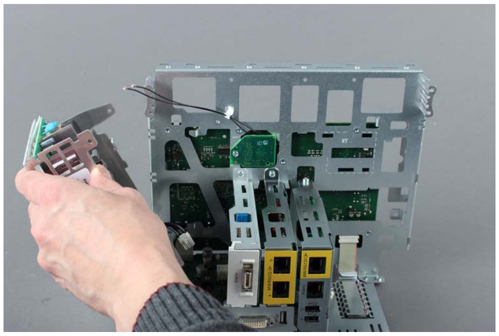


6 Disconnect the cable connecting the power supply to the standard system interface board.

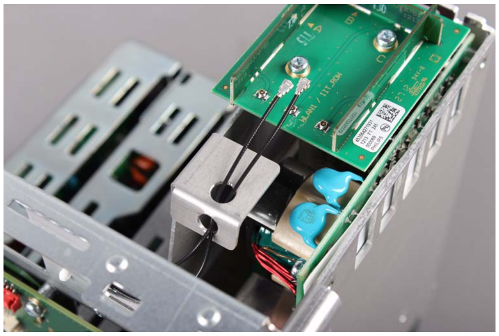


7 Remove the power supply.





8 Reassemble the monitor by performing the above steps in reverse order. Before connecting the antenna cables to the antenna board, make sure to pull them through both guidance holes in the metal sheet.

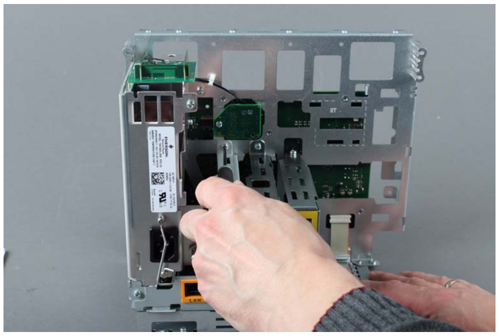


Removing I/O Boards

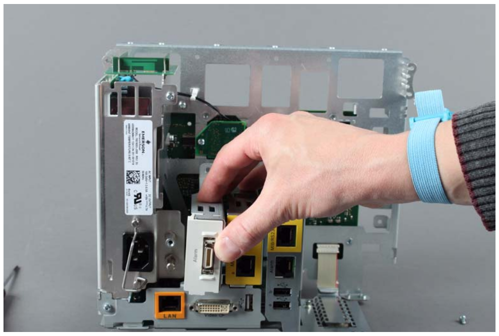
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 Remove the screw securing the I/O board you wish to remove.



4 Remove the I/O board by pulling it towards you.



NOTE

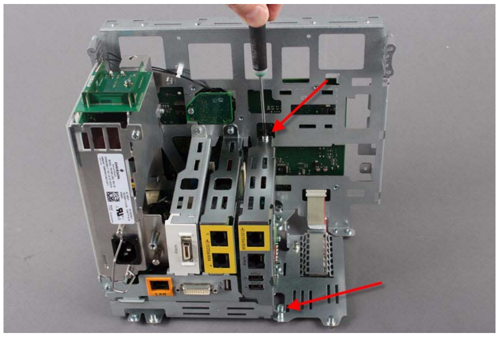
When replacing the I/O boards, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

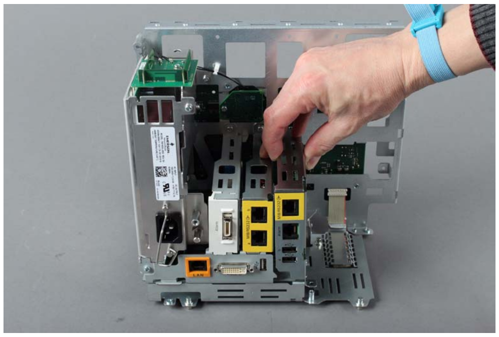
Removing the Advanced System Interface Board

1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 Remove the two screws securing the advanced system interface board and lift the board upwards to remove it.





NOTE

When replacing the advanced system interface board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

Removing the Standard System Interface Board

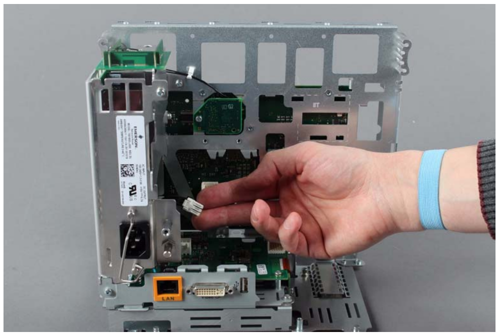
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

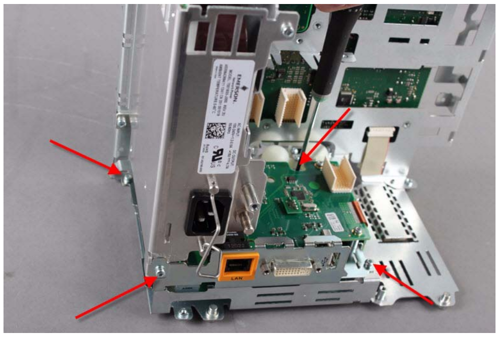
3 Remove all I/O boards as described in “Removing I/O Boards” on page 178.

4 Remove the Advanced System Interface Board as described in “Removing the Advanced System Interface Board” on page 179.

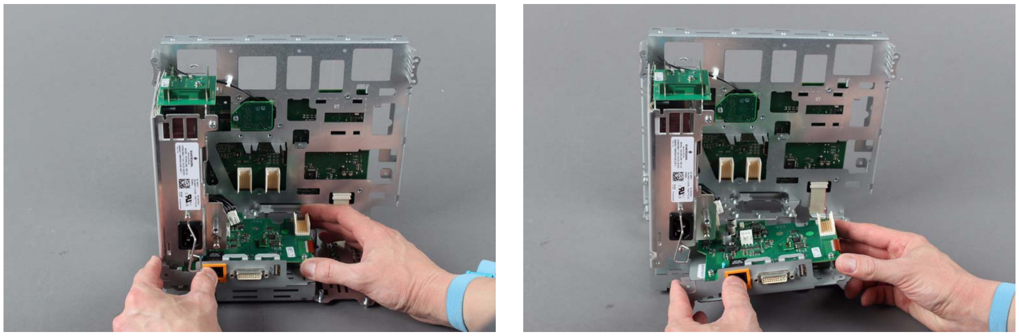
5 Disconnect the cable connecting the power supply to the standard system interface board.



6 Remove the four screws securing the standard system interface board.



7 Remove the standard system interface board.



8 When reassembling the standard system interface board, press against the main board connector so it clicks into place.

NOTE

When replacing the standard system interface board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

Removing the Main Board

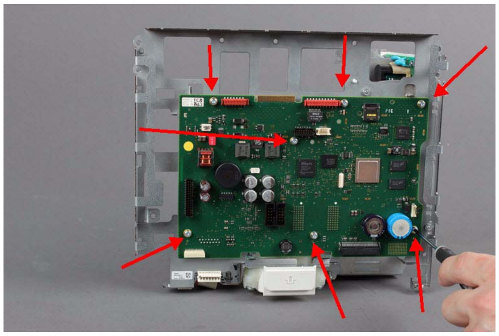
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 Remove all I/O boards as described in “Removing I/O Boards” on page 178.

4 Remove the WLAN board as described in “Removing the WLAN board” on page 174.

5 Remove the seven screws securing the main board and remove the main board.



NOTE

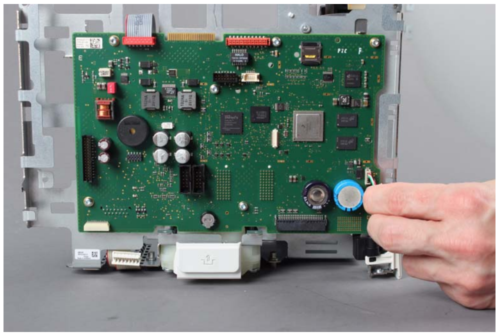
When replacing the main board, the monitor must have the (hardware) serial number reloaded. Support Tool Mark2 is required to perform this task. For details please refer to the Support Tool Instructions for Use.

Removing the Side USB Connector

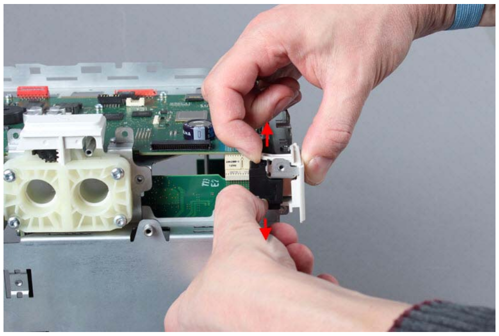
1 Separate the front and back of the monitor as described in “Separating the Front and Back of the Monitor” on page 146.

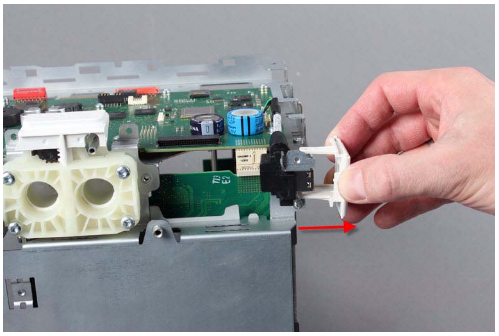
2 Remove the rear housing as described in “Removing the Rear Housing” on page 169.

3 Disconnect the side USB connector cable from the main board.

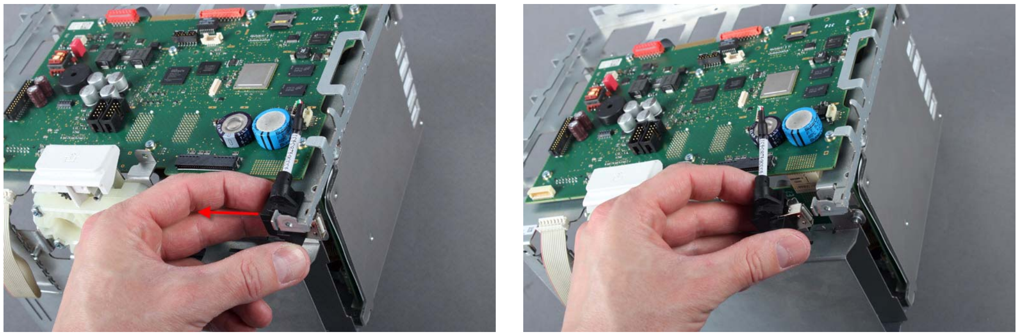


4 Pull the latches of the side USB cover apart and remove the cover.



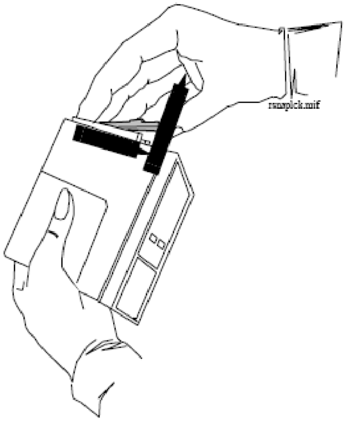


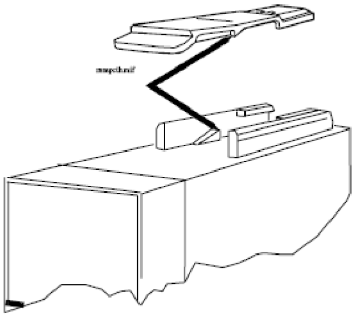
5 Pull out the side USB connector from the main metal chassis.



Plug-in Modules

The snap lock holds the plug-in module in the module rack.





To remove the snap lock:

1 Grip the module firmly in one hand and using your thumb, pull the front edge of the snap lock away from the plug-in module so that the lug on the snap lock clears the retaining edge of the module.

2 Push on the rear edge of the snap lock to move the snap lock through the slot toward the front of the module until it is clear.

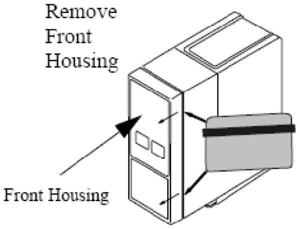
To replace the snap lock:

1 Locate the snap lock into the slot on the bottom of the module.

2 Slide the snap lock toward the rear of the module until the lock snaps into position.

Plug-In Module Disassembly

Disassembly of the parameter module enables replacement of the front assembly.



Removing the Module Front Housing

WARNING

When you disassemble/assemble a plug-in module an applied part leakage current test must be performed before it is used again for monitoring.

To disassemble a plug-in module:

Remove the front housing.

- Place the module on a flat surface and insert a card (similar to a credit or cheque type card) into one side of the module to disengage the 2 tabs securing the front housing to the module housing.
- Pull the edge of the front housing away from the module housing.
- Carefully turn the module over so the free edge does not reengage and repeat the first two steps on the other side of the module. The front housing should now be free of the module housing.

To reassemble a plug-in module:

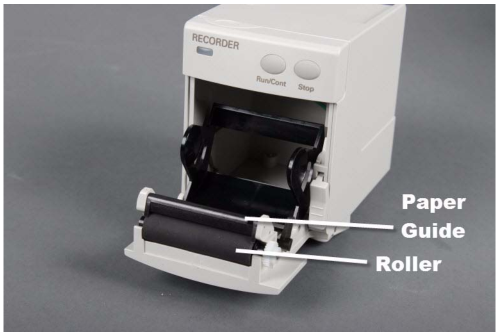
Snap-fit the front housing onto the front of the module case so the openings in the front housing match the LEDs and keys.

Recorder Module Disassembly (M1116C)

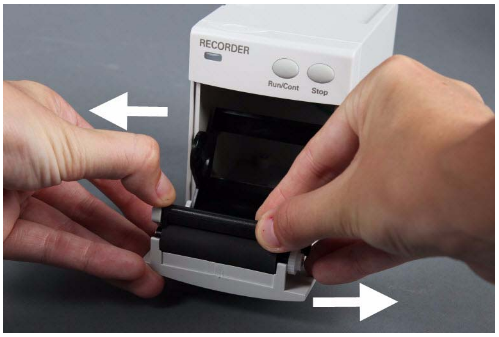
Please follow the disassembly procedures below, do not disassemble the recorder past the point described.

Disassembly of the Roller

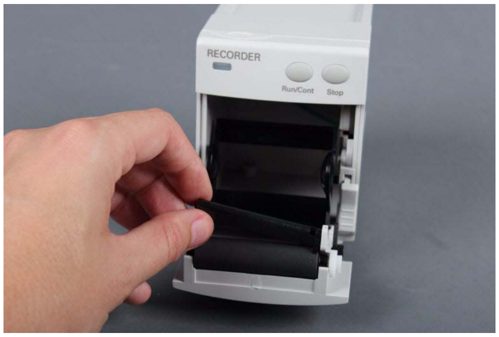
1 Open the recorder door and remove the paper roll. In order to exchange the roller, you must remove the paper guide first.



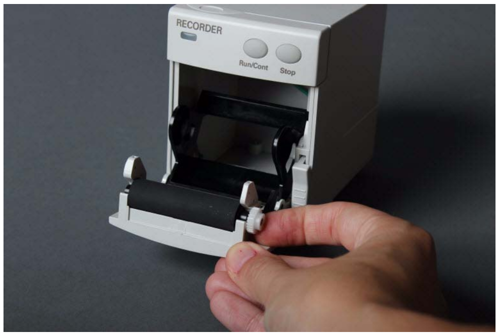
2 Carefully remove the paper guide from its position by pulling the gray holder to the left and the paper guide to the right.



3 Lift up the paper guide on the left side and remove it.



4 Pull the roller towards you and remove it.



Assembly of the Roller

1 Assemble both parts by performing the above steps in reverse order.

2 Make sure that all parts click into place.

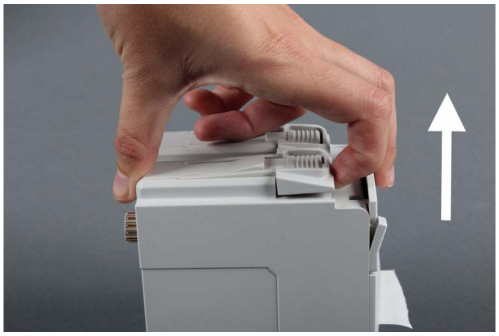
Disassembly of the Snap Lock

NOTE

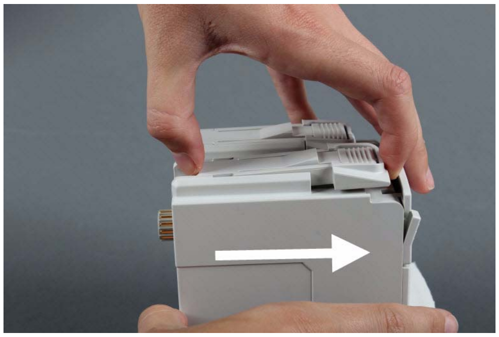
Do not use snap locks other than the snap lock kit 453564456791 for the M1116C recorder. Using any other snap lock will result in the recorder door not being able to be opened anymore.

1 Turn the recorder upside down, with the snap locks facing upwards.

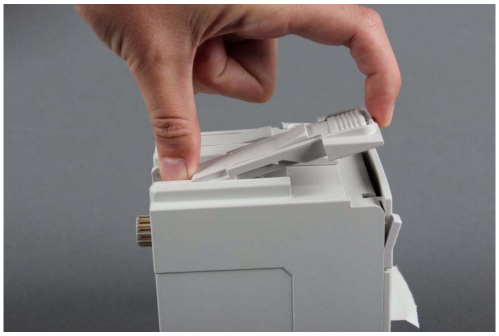
2 Lift the release lever up a few millimeters.



3 While lifting up, push the snap lock once with your thumb in the direction of the door in order to release it from its rail. Then slide it all the way out.

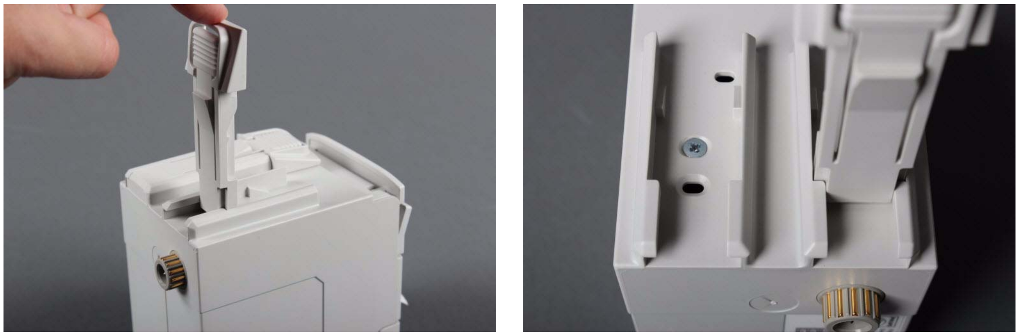


4 Lift the snap lock up in order to remove it.



Assembly of the Snap Lock

1 Hold the new snap lock perpendicular to the recorder, as shown in the pictures below.



2 Lay the snap lock down on its guiding rail and push into its position.

3 Slide until you hear a click that indicates a proper fit.

Multi-Measurement Module (MMS) Disassembly

Please follow the disassembly and reassembly steps below closely. Do not disassemble the MMS past the point described in the procedures below.

Tools required

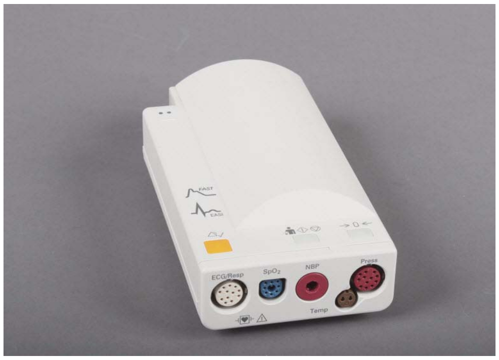
- thin-bladed screwdriver
- Allen wrench (size 6)
- ESD mat and wrist strap

WARNING

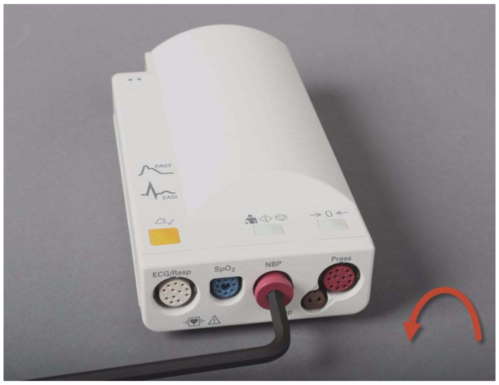
- Do not open the MMS while it is connected to a monitor.
- Parts inside the instrument may be contaminated with bacteria. Protect yourself from possible infection by wearing examination gloves during this procedure.

Removing/Exchanging the NBP Inlet

1 Position the MMS as in the picture below.



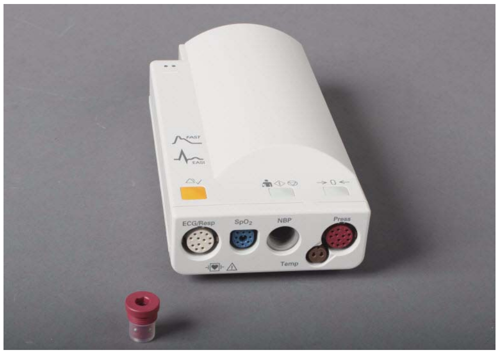
2 Slowly turn the connector counterclockwise with an Allen wrench until it is released.



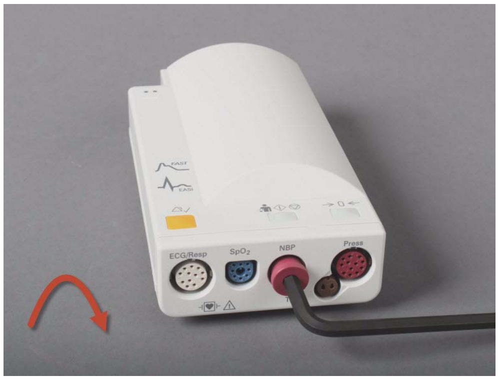
NOTE

When releasing the connector be careful not to remove its transparent cover.

3 Verify that the connector contains all 4 metal balls in the transparent cover. If a ball is missing, it may have fallen into the NBP connector chamber.



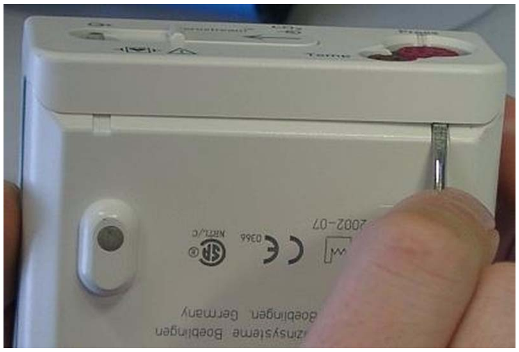
4 Insert the new connector using the same wrench, turn it clockwise and tighten the connector carefully

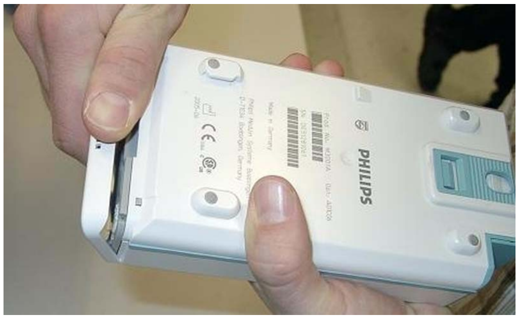


5 Perform a visual check of the new connector once it is assembled. Verify that the hole in the silicone cover is round and not oval or otherwise deformed because this can cause leakage. Perform the NBP Performance test as outlined in chapter “Testing and Maintenance”.

Removing the Front Cover

1 Position the thin-bladed screwdriver in the small slot provided for this purpose. Remove the front cover by pulling it away from the MMS until it snaps off. There may be a slight resistance when removing the front cover.

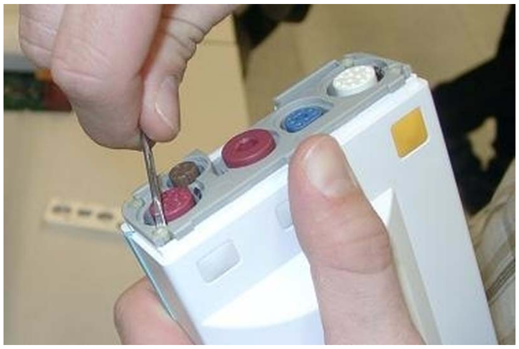




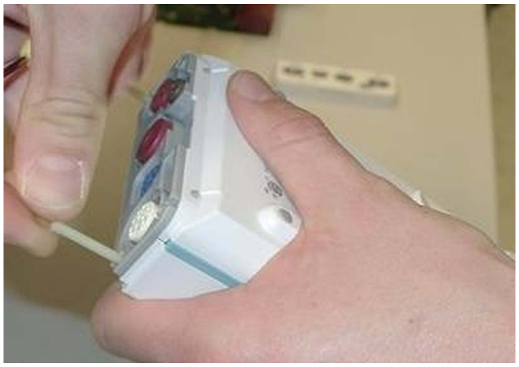
Removing the Mounting Pin

1 Position the MMS with the connectors facing towards you. There are four long mounting pins threaded into the MMS in each of the four corners under the cover. Locate the heads of the two long mounting pins on the top cover and only remove these.

2 Use the thin-bladed screwdriver to lift the pins gently out, far enough that they can be removed manually.



3 Remove the two pins and set them aside for refitting.

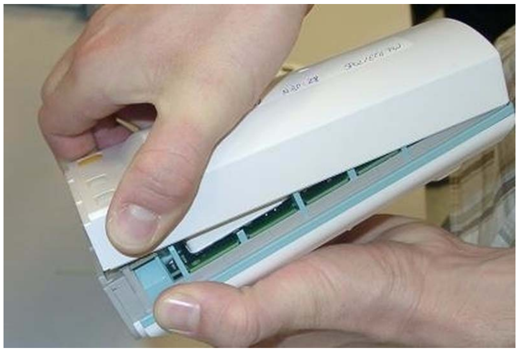


NOTE

Without these long mounting pins, the MMS will not function properly

Removing the Top Cover

Begin by gently pulling the top cover away from the MMS. The top cover is press-latched at the MMS connector. There might be a resistance due to the rubber sealing. Remove the cover slowly, without hitting or touching the inside of the MMS.

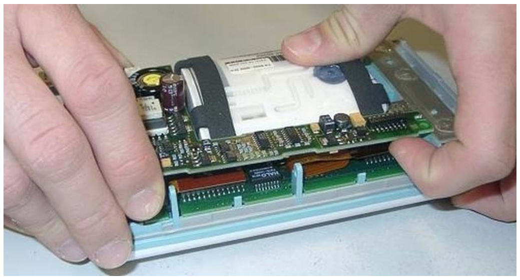


Exchanging / Removing the DC/DC Board

NOTE

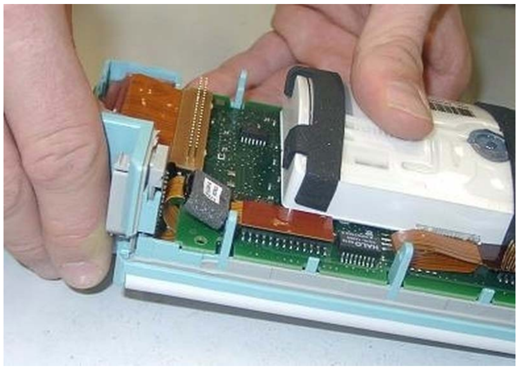
The HW Rev C MMS (S/N prefix DE610xxxxx) does not have a separate DC/DC board anymore.

The DC/DC board is connected to the main board. Loosen the pin connection to the main board and remove the DC/DC board by gently lifting it up. Avoid touching the surface of the board. Set it aside where it is ESD protected.

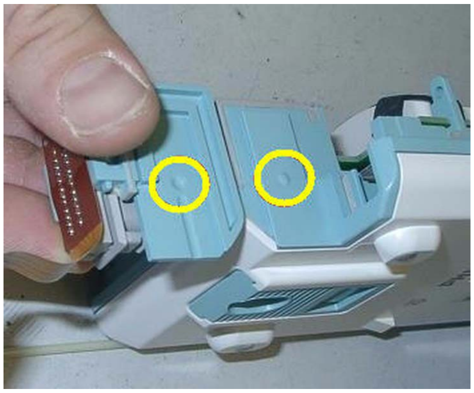


Removing the MSL Flex Assembly

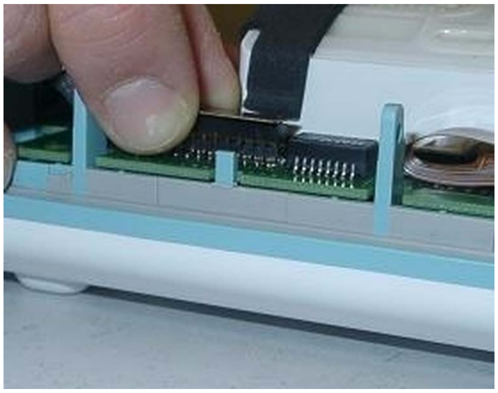
1 After the DC/DC board is removed, lift up the MSL frame connector to which the MSL Flex is attached.



At the beginning there might be resistance due to the special fixing mechanism shown in the picture below.

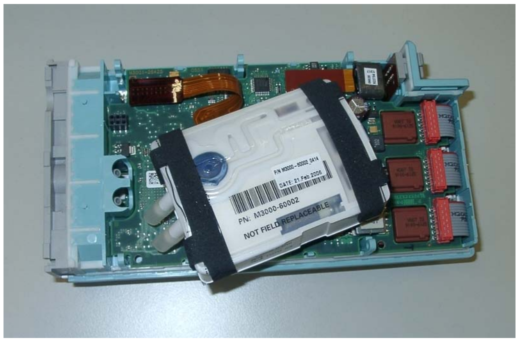


2 Lift up the flex connector carefully. Do not bend the connector pins on the main board.

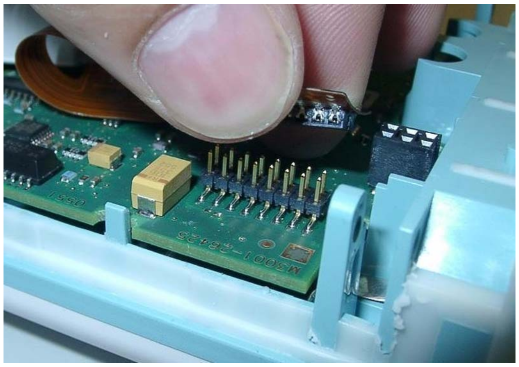


Removing the NBP pump

1 Remove the pump by lifting it up. Set the pump aside. Also remove the old silicon tubes.

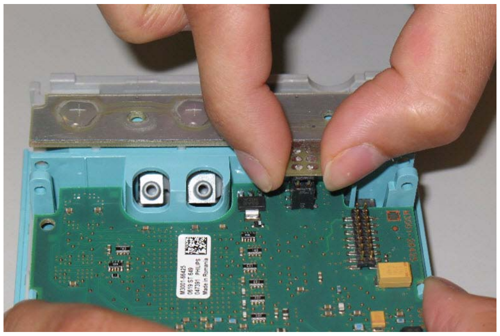


2 Remove the connector of the NBP pump assembly. The connector may sit tightly. Gently loosen the connector.

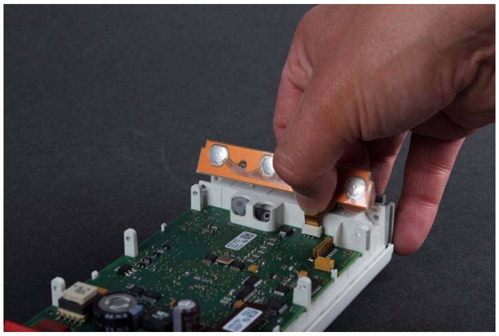


Removing the Keypad

1 Remove the keypad by lifting it straight up.



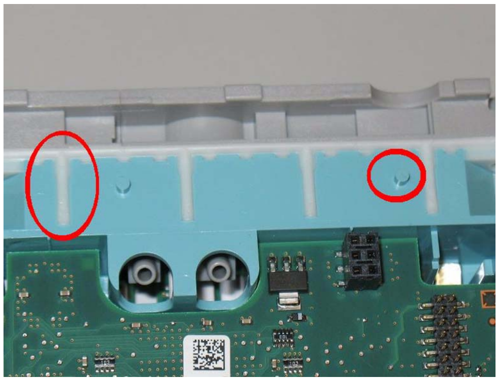
Rigid Keypad Connection



Flexible Keypad Connection

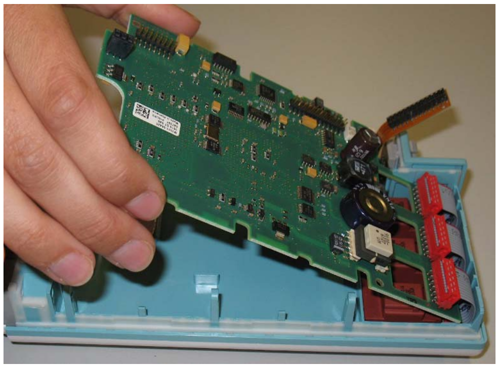
NOTE

The rubber sealing and the guides (marked with red circles) may hold the keypad firmly in place. Therefore it may be necessary to loosen the keypad first. Do this carefully to avoid any damage.

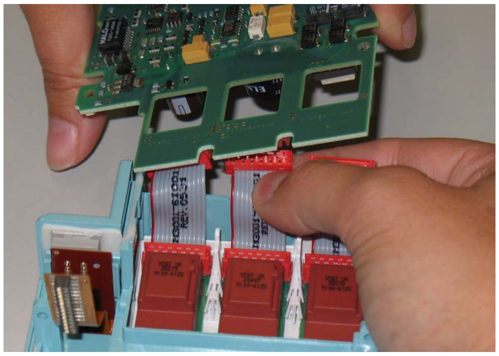


Removing the Main Board

1 Lift up the main board as shown below. Then turn it over and continue with step 2.



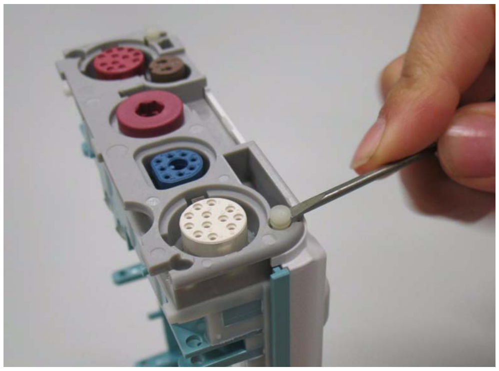
2 Remove the connectors to the main board starting from the right side.



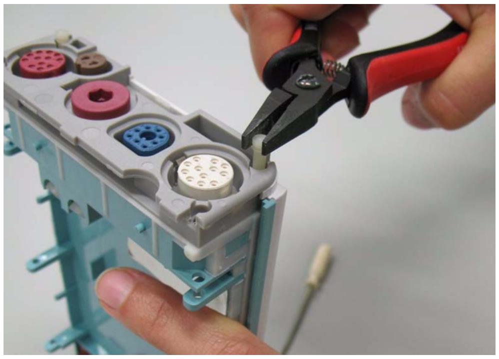
Removing the Measurement Board

1 Position the MMS with the connectors facing towards you. There are four long mounting pins threaded into the MMS in each of the four corners under the cover. Locate the heads of the two long mounting pins on the bottom cover. Only these need to be removed.

2 Use a thin-bladed screwdriver to gently lift the pins out far enough so they can be removed with pliers.



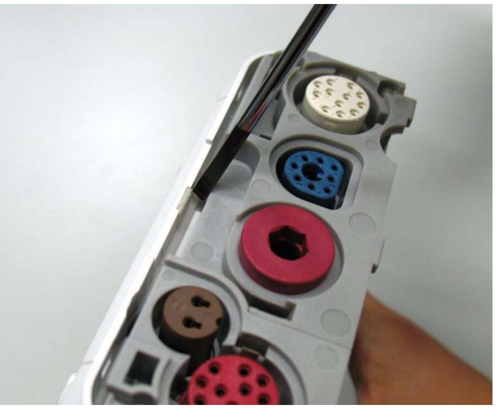
3 Remove the two pins and set them aside for refitting.



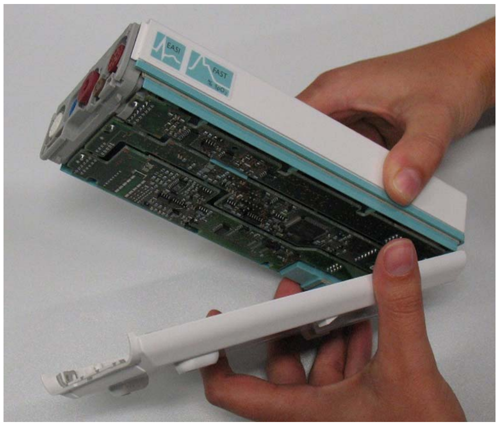
NOTE

Without these long mounting pins, the MMS will not function properly.

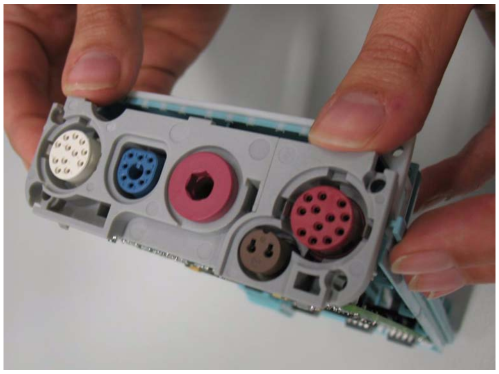
4 Loosen the bottom cover gently. Use the screwdriver and position it in the gap between bottom cover and measurement block, then twist the screwdriver. **Do not push the screwdriver into the device as you may damage electronic components inside.**



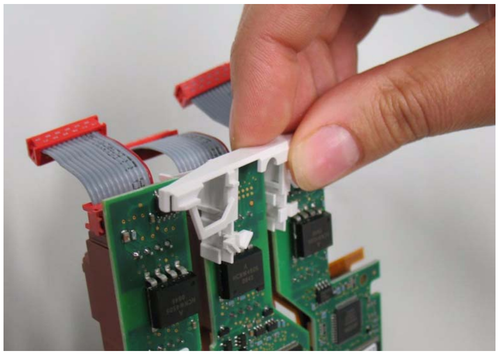
5 Remove the bottom cover. There may be a slight resistance when opening the cover.



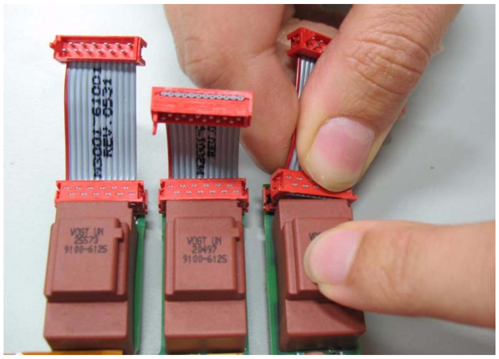
6 Loosen the measurement block by pushing the block forward while holding plastic chassis. Then remove the measurement block.



7 The spacer keeps the measurement boards in place. Remove the spacer by lifting it up.



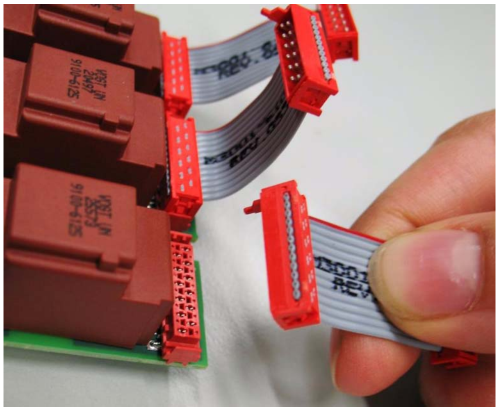
8 Remove the measurement ribbon cable. Twist the cable slightly in order to loosen it.



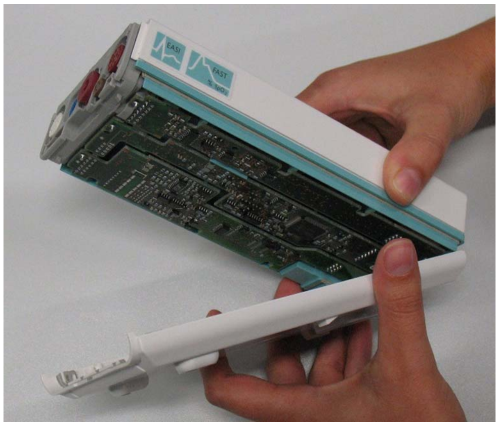
Reassembling the Measurement Block

1 Insert the spacer to keep the measurement block in place.

2 Make sure that you insert the measurement cable correctly. Please refer to the picture below for the appropriate orientation. A cable inserted incorrectly may cause a <Measurement>Malfunction INOP.

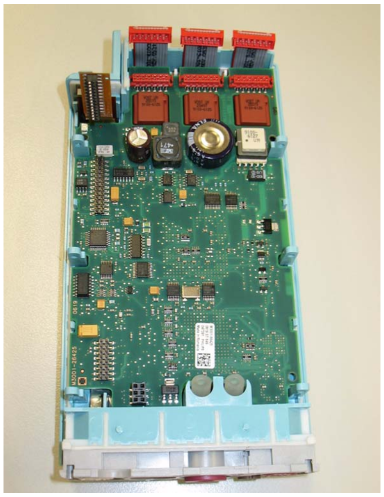


3 Make sure the measurement block is inserted as shown below. Make sure that there is no gap between the chassis and the bottom.

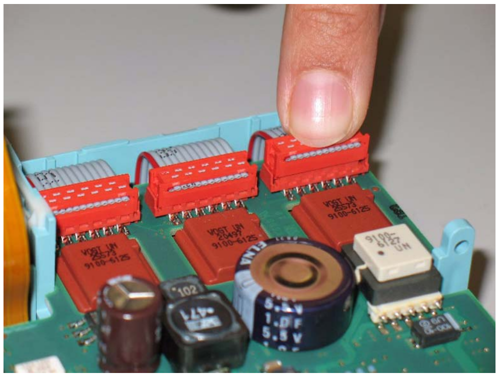


Refitting the Main Board

1 Insert the new main board. Make sure the main board is seated correctly.

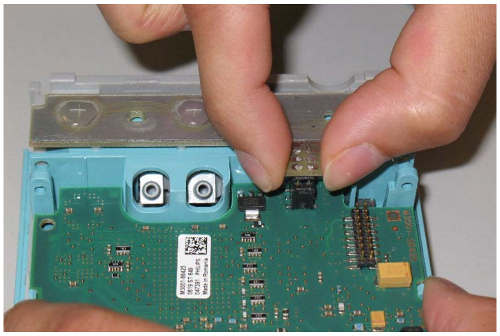


2 Re-establish the connection to the measurements. Make sure the connection is tight. If it is not connected correctly, a corresponding measurement malfunction INOP may occur.



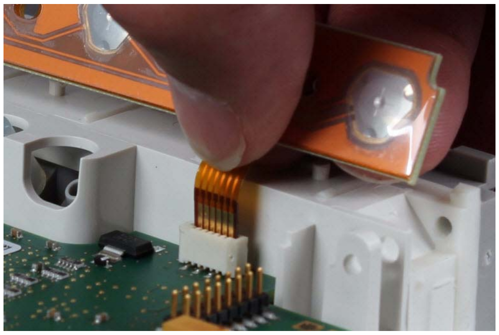
Refitting the Keypad - Rigid Keypad Connection

1 Reinsert the key pad. Make sure it is positioned correctly.

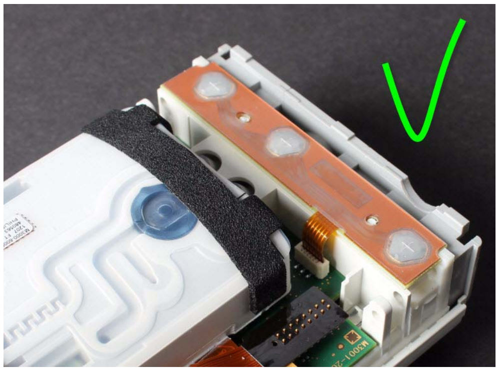


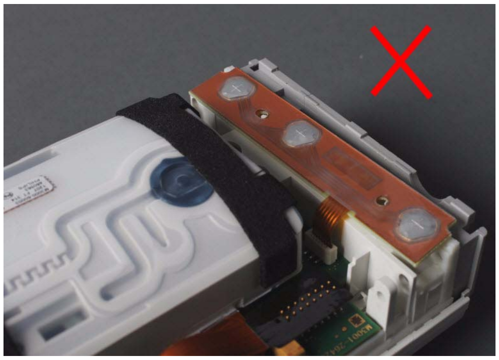
Refitting the Keypad - Flexible Keypad Connection

1 Reinsert the keypad with flex cable. make sure that the flex cable is inserted as shown below.



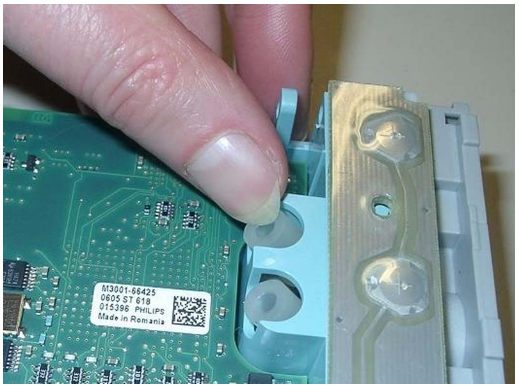
2 Make sure the keypad is correctly positioned in the guiding rails.



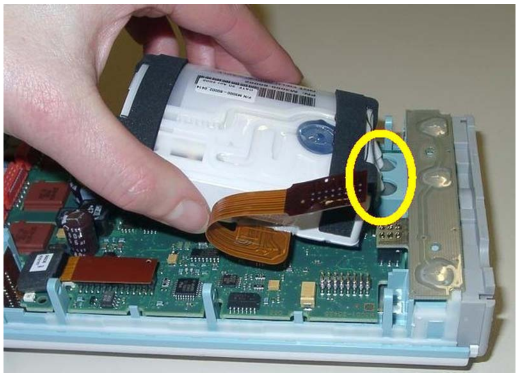


Refitting the new NBP Pump

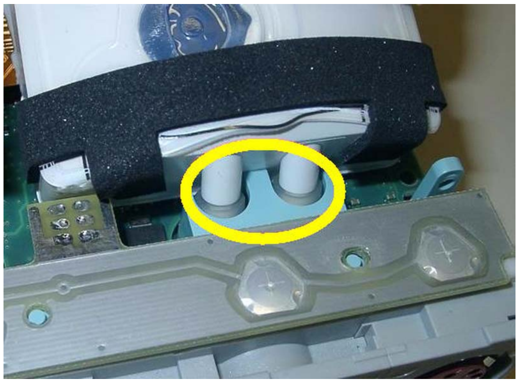
1 Insert new silicon tubes. Make sure they are seated correctly by pressing them into their position.


M3001-66425
0605 ST 618
015396 PHILIPS
Made in Romania

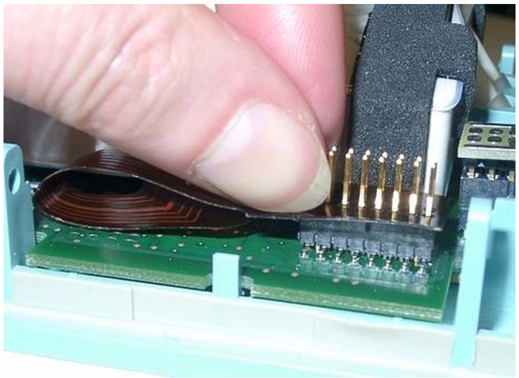
2 Insert the new pump assembly. Lift up the back and press the airways onto the silicon tubes.



3 Make sure the airways have a tight connection to the silicon tubes.



4 Insert the connector of the NBP assembly into the connector on the main board. Do not crease the flex cable. M3001A HW A/B and M3000A have a post connector with long pins. Press down the connector until there is no gap between the connectors.

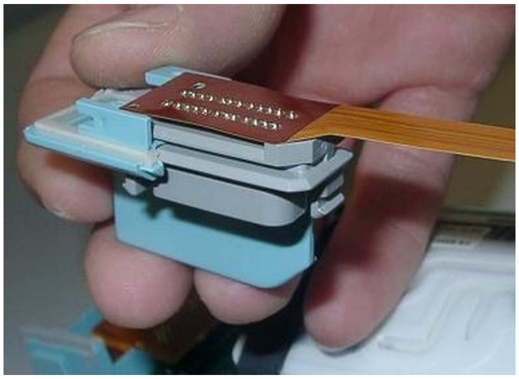


NOTE

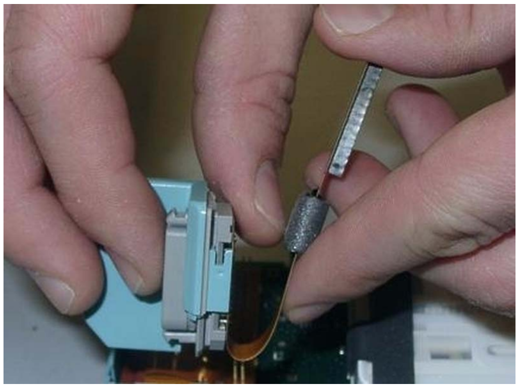
If the NBP pump is replaced, you need to perform an NBP Performance Test and Calibration afterwards.

Reassembling the MSL Flex Assembly

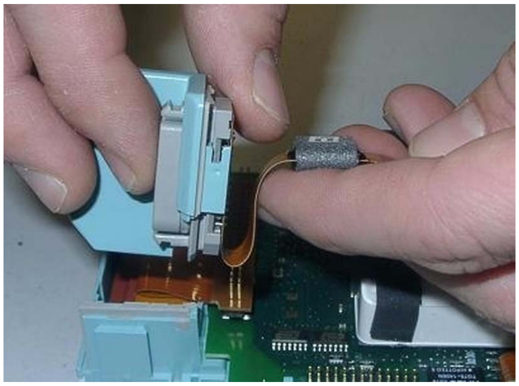
1 Insert the MSL Flex layer into the frame connector as shown below by moving it into the appropriate dove tail.



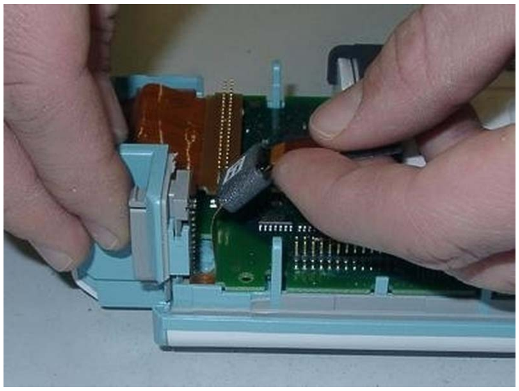
2 To insert the MSL Flex into the MMS, it has to be bent carefully. Bend the MSL Flex in a 180 degree angle as shown below. Do not crease the flex.



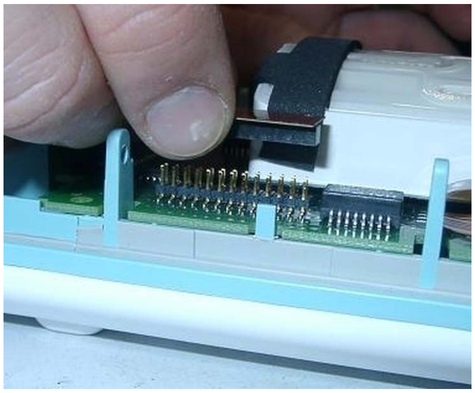
3 The second bend has to be done as shown below. To be able to connect the MSL flex to the main board afterwards, the flex has to be bent in a 90 degree angle as shown in the picture. Do not crease the flex.



4 Insert the frame connector with the attached and bent MSL Flex. Be careful not to damage the MSL flex when pushing the frame connector downwards.



5 Position the connector correctly and push it into place.

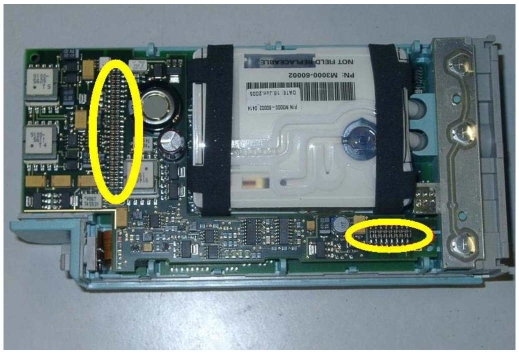


Refitting the DC/DC board

NOTE

This step only has to be done on HW A/B

Position the DC/DC board and press it down gently. Make sure it is connected properly to both connectors indicated in the picture.



Refitting the Top Cover

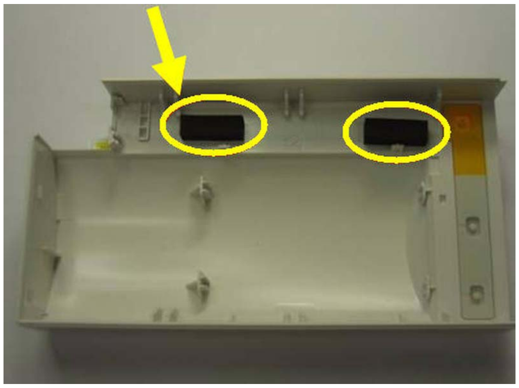
NOTE

To change the top cover of a HW Rev C MMS (S/N prefix DE610xxxxx) you have to attach the two cushions which are part of the Top Cover Assembly. These two cushions secure the connection of the MSL Flex and the NBP Flex.

NOTE

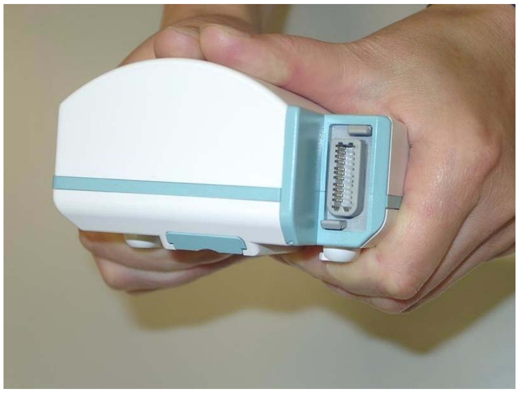
Perform the following two steps only on an MMS HW Rev C

1 Stick the two cushions onto the marked positions inside the top cover.

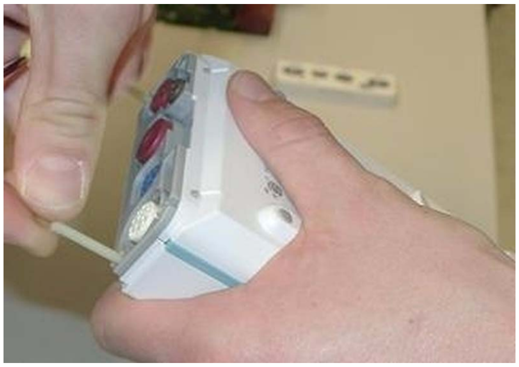


2 Position the top cover, then press it back into place until you hear a click or there is no longer a gap between the two covers.

3 The cover has a rubber seal, press the cover firmly together.



4 Holding the bottom cover firmly in place, slide the two long mounting pins completely back into the MMS. Make sure there is no gap between the top and bottom cover.



Refitting the Front Cover

To refit the front cover, press it back into place over the measurement connector hardware until you hear a click.

Final Inspection

Perform a final inspection to ensure that:

- The MSL connector is positioned correctly
- There are no gaps between the MSL connector and the cover
- there is no gap between the top and bottom cover

Testing

To ensure that the MMS is functioning correctly, you must perform safety tests and a performance check on it. Please refer to the "Testing and Maintenance" chapter of this service guide.

WARNING

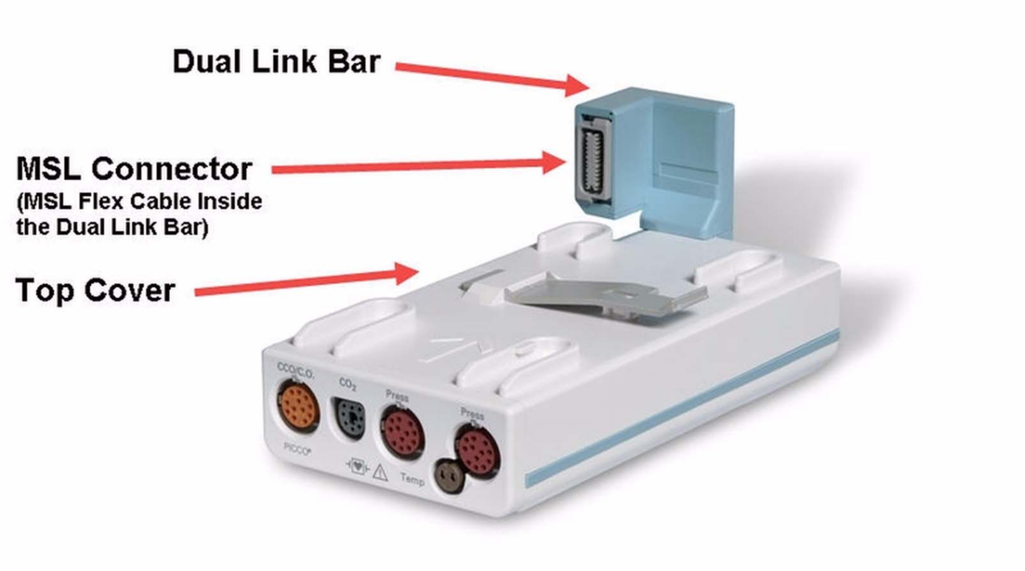
When you disassemble/assemble an MMS, an applied part leakage current test must be performed before it is used again for monitoring.

MMS Extensions - Exchanging the Top Cover, MSL Flex Cable and the Dual Link Bar

This section describes the exchange procedures for:

- The Top Cover with new release mechanism
- The Dual Link Bar incl. the MSL Flex Cable.

for all MMS Extension (MSE) types (M3012A, M3014A, M3015A, M3016A).


Dual Link Bar
MSL Connector
(MSL Flex Cable Inside the Dual Link Bar)
Top Cover
CCO/C.O.
CO2
Press
Press
PiCCO
Temp

Exchange Procedures

NOTE

Please follow the disassembly and reassembly steps closely.

Tools Required:

A thin-bladed screwdriver and a thick-bladed screwdriver, ESD mat and wrist strap

WARNING

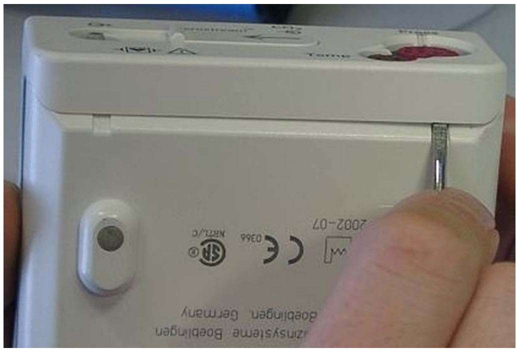
- Do not open the MSE while it is connected to a monitor.
- Parts inside the instrument may be contaminated with bacteria. Protect yourself from possible infection by wearing examination gloves during this procedure.

NOTE

Once you have reassembled the MSE, you must perform a performance check on it. Please refer to the "Testing and Maintenance" chapter of this service guide .

Removing the Front Cover

1 Position the thin-bladed screwdriver in the small slot provided for this purpose. The front cover (Bezel) then clicks away from the Extension. Remove the front cover



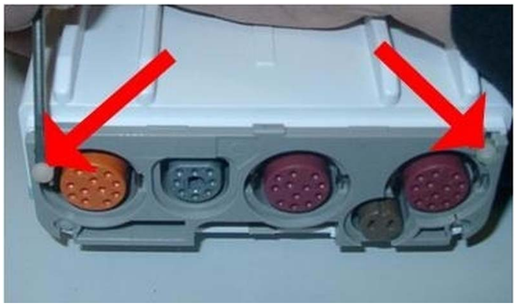
NOTE

There might be a slight resistance when you remove the front cover.

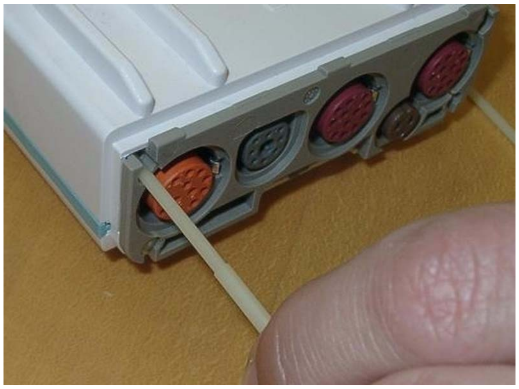
Removing the Mounting Pin

1 Position the MSE on the dual link bar with the measurement connector hardware facing upwards and the arm of the dual link bar away from you. There are four long mounting pins threaded into the MSE in each of the four corners under the cover. Locate the heads of the two long mounting pins on the top housing and only remove these.

2 Use the thin-bladed screwdriver to lift the pins gently out far enough so they can be removed manually.



3 Remove the two pins and set them aside for refitting.

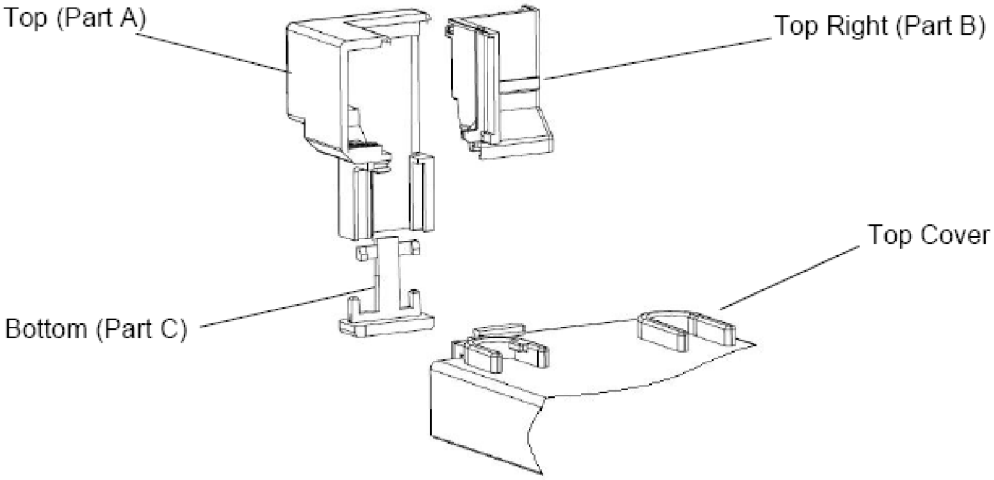


NOTE

Without these long mounting pins the MSE will not function properly.

Removing the Dual Link Bar

The Dual Link Bar consists of three parts as shown below. Follow the specific steps carefully to remove the Link Bar.

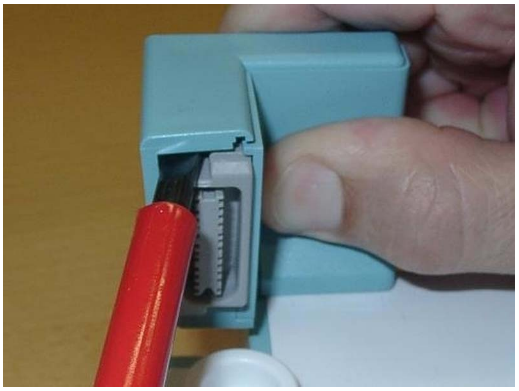


CAUTION

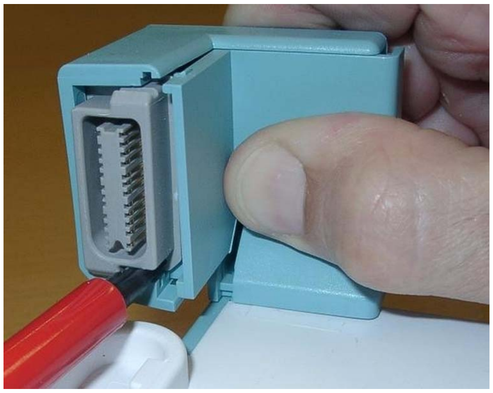
Do not try to remove the link bar with force as this can damage the MSL Flex Cable

1 Position the MSE with the measurement connector hardware facing towards you.

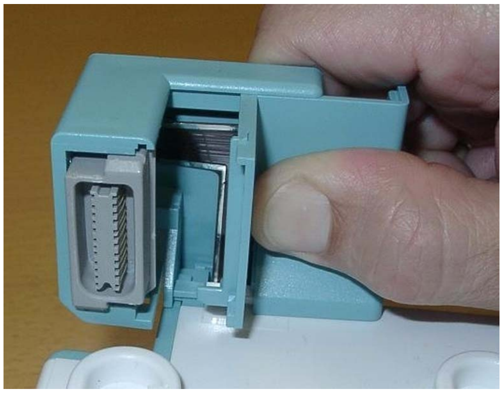
2 Hold the link bar as shown below. While pressing gently on part B, insert a thick-bladed screwdriver between the MSL connector and part A. Twist the screwdriver to the left and at the same time slide part B to the right, so it is released at the top.



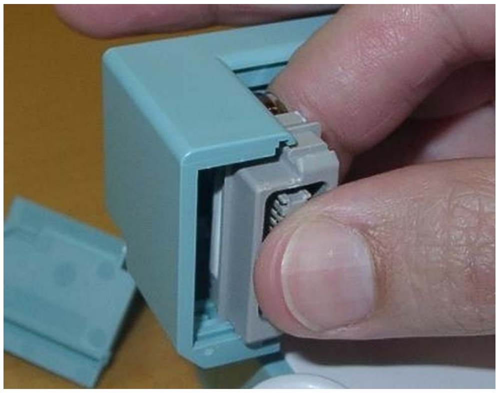
3 Repeat Step 2 at the bottom.



4 Slide part B to the right. If part B fails to move to the side, please repeat steps 2 and 3.



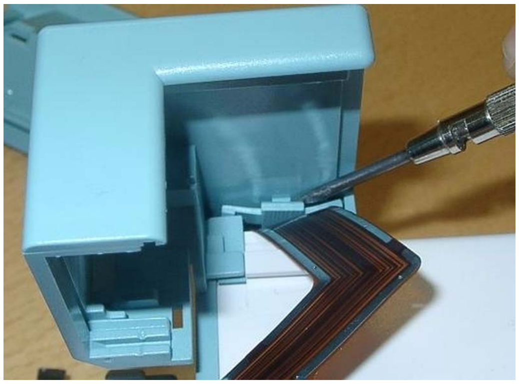
5 Now the MSL Flex connector can be moved to the right.

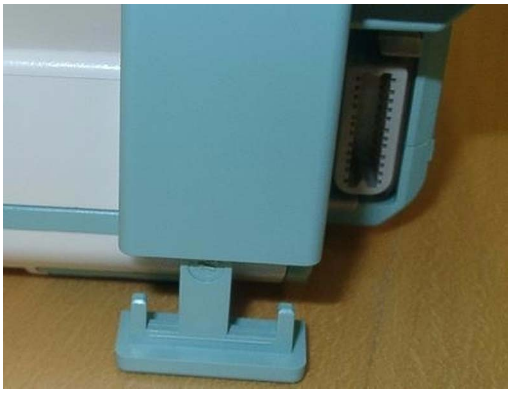


NOTE

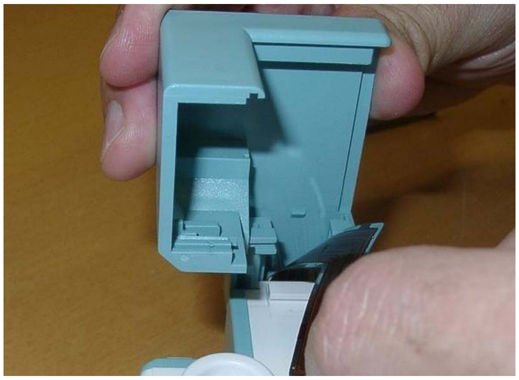
Make sure that the movement of the screwdriver does not pinch the MSL flex cable.

6 Insert the thin-blade screwdriver behind the release mechanism of part C. Carefully twist the screwdriver, then press gently so that part C drops down.





7 Lift part A upwards. It is fixed in a dovetail. Be careful with the MSL flex.



Removing the Top Cover

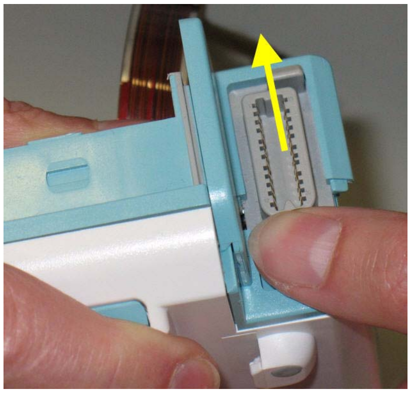
Begin by gently pulling away the top cover from the MSE. The top cover is press-latched at the link bar end. Remove it slowly, without hitting or touching the inside of the MSE.

Replacing the Flex Cable Assembly

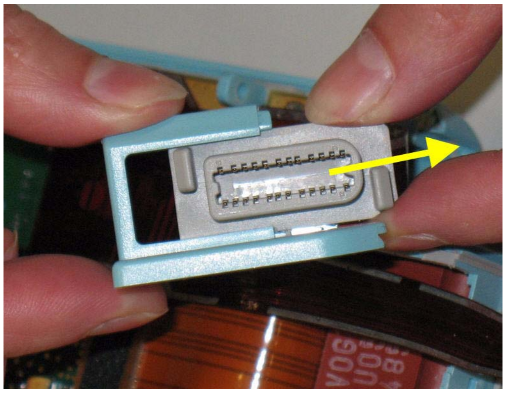
1 Hold the Extension firmly and push upwards against the connector. Then slide connector (together with the connector holder) out of the dovetail connection.

NOTE

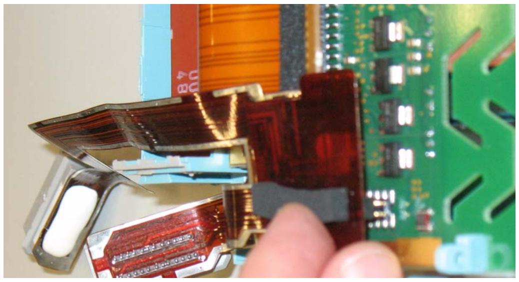
You will probably need to apply some more force at first until the holder slides out of its mechanical lock.



2 Slide the connector out of its holder.

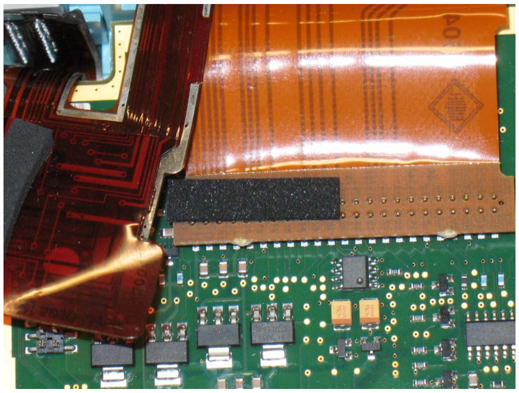


3 Remove the flex cable connector on the MSE board. Be careful not to bend any pins on the female part of the MSE connector.

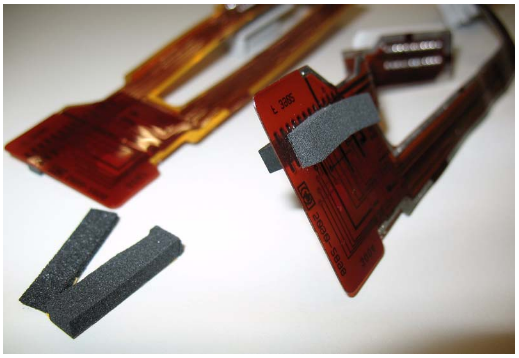


NOTE

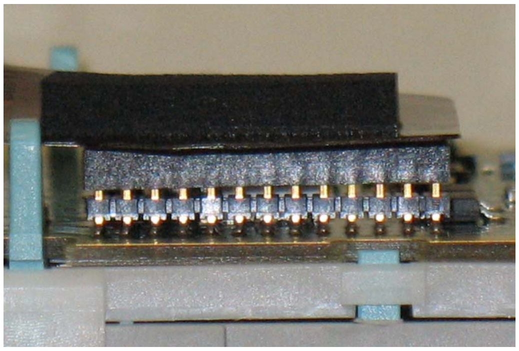
Some units may have a foam pad on the connector of the inner flex cable of the MSEs (as shown below) and some units may not. This has no impact on the functionality of these units.

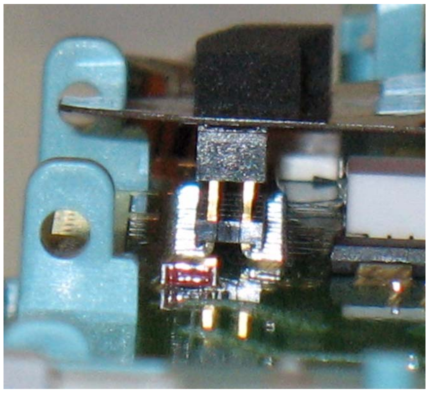


4 Stick the correct foam pad on the rear side of the inner connector. Use the thick pad for : M3012A, M3014A, M3016A. Use the thin pad for: M3015A. You can also check the old flex cable for the correct pad.



5 Insert the flex cable connector into the female receptacle on the MSE board. **Check from the side and the front that the connector is inserted correctly (there is no mechanical guidance) and that no pins are bent, otherwise you may damage the MSE when powering it on.**

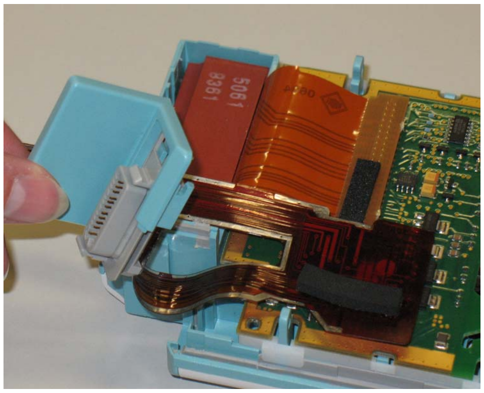




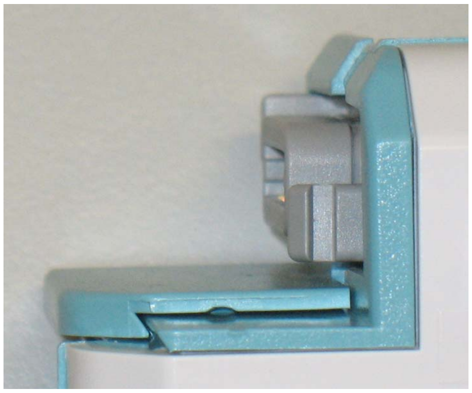
WARNING

A misplaced connector might damage the MSE or the monitor.

6 Slide the connector into the holder as shown below. Arrange the flex cable in the space beside and underneath the board (be careful not to bend the cable) while positioning the holder for insertion.



7 Insert the holder with the connector into the dovetail connection and slide it down until you hear a click.



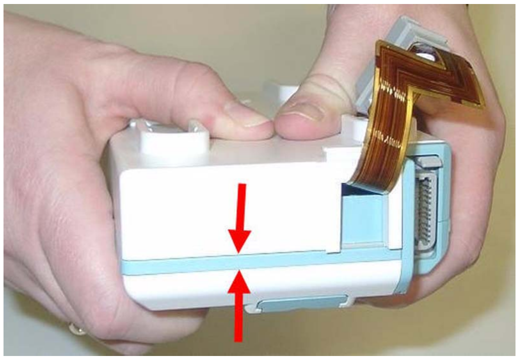
Refitting the Top Cover

NOTE

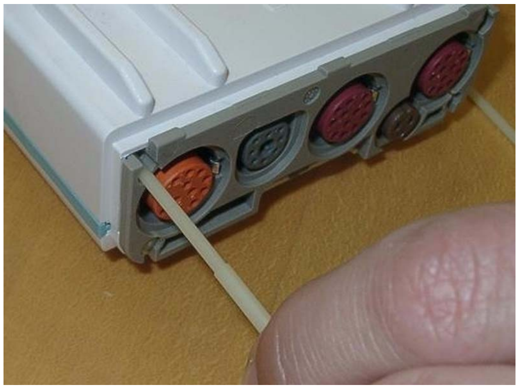
Be careful with the MSL Flex cable. Make sure it does not get stuck between the covers.

1 Position top cover, then press the bottom cover back into place until a click is heard.

2 The cover has a rubber seal. Press the covers firmly together and make sure there is no gap between the top and bottom cover.



3 Holding the bottom cover firmly in place, slide the two long mounting pins completely back into the MSE.

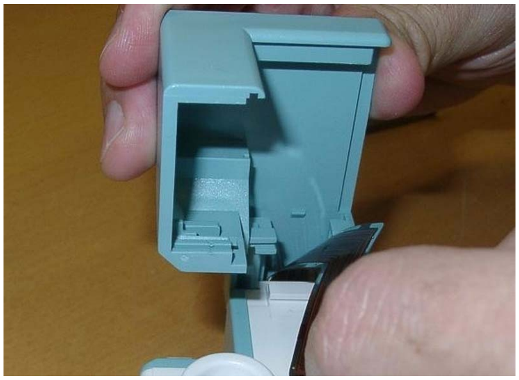


Assembling the dual Link Bar

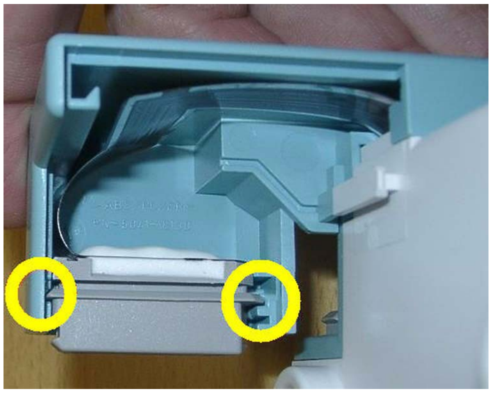
CAUTION

Do not try to assemble any part of the link bar with force as this can damage the MSL Flex Cable.

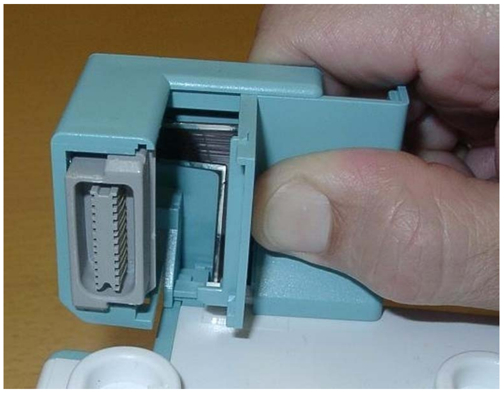
1 Position part A into the dovetail and slide it down.



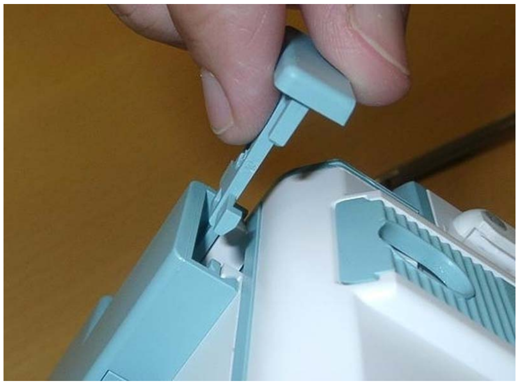
2 Make sure the MSL Flex connector is positioned in the correct slot (See indicated slots below). Then push it gently into part A.



3 Making sure the MSL flex cable lies flat in part A of the assembly, place part B into the dovetail and close the open link bar.

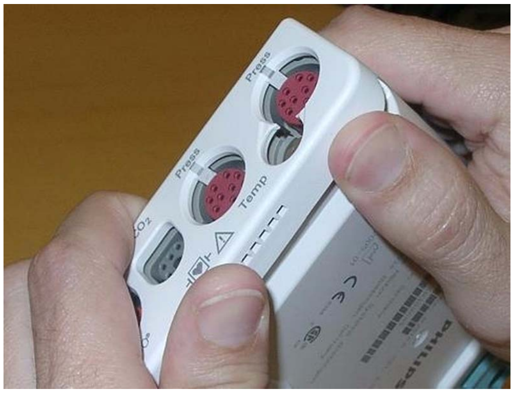


4 Turn the MSE around and insert part C into the bottom part of the link bar. When you hear a click, part C is correctly inserted.



Refitting the Front Cover

To refit the front cover, press it back into place over the measurement connector hardware until you hear a click.



Final Inspection

Perform a final inspection to ensure that:

- The link bar is positioned correctly
- There are no gaps between the link bar parts
- There is no gap between the top and bottom cover

Testing

To ensure that the MSE is functioning correctly, you must perform a performance check on it. Please refer to the "Testing and Maintenance" chapter of this service guide.

WARNING

When you disassemble/assemble an MMS Extension, an applied part leakage current test must be performed before it is used again for monitoring.

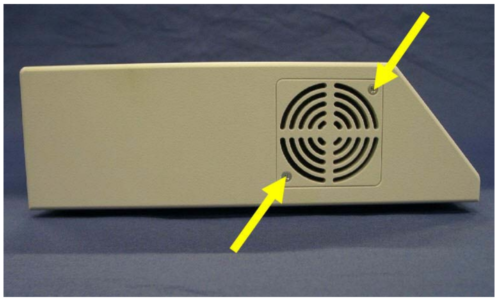
Smart Battery Conditioner LG1480 (865432)

You should clean both air filter mats on a regular basis. Depending on the frequency of use and the environmental conditions (dust etc.), the interval can range from 6 to 24 months.

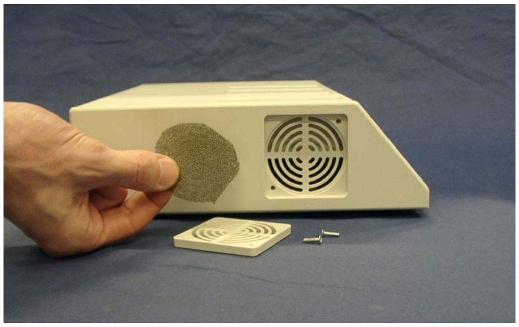
Cleaning the Air Filter Mats

The air filters are located on the right and left side of the battery conditioner. Perform the procedure below for each side.

1 Remove the 2 screws securing the filter cover and take off the cover.



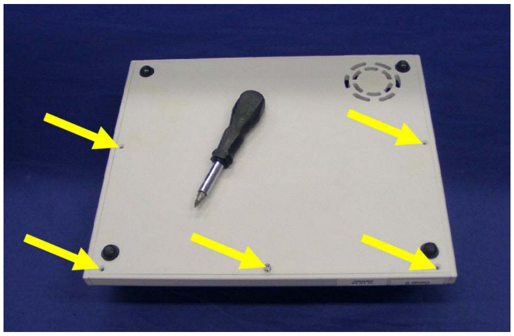
2 Remove the filter mat and clean the dust out by shaking.



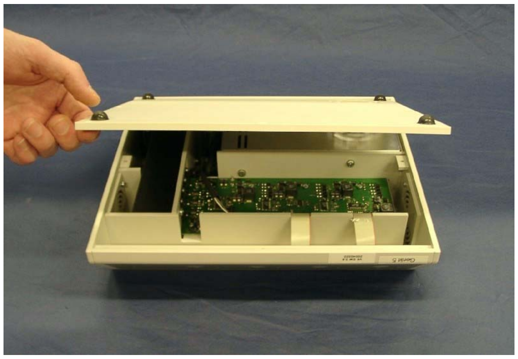
3 Re-insert the mat and refit the cover and screws.

Replacing the Fan

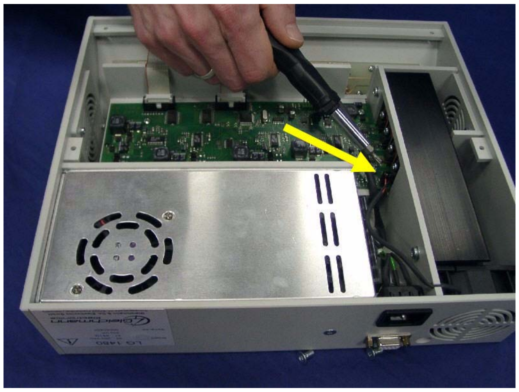
1 Turn the battery conditioner upside down and remove the 5 screws at the bottom with a T20 screwdriver.



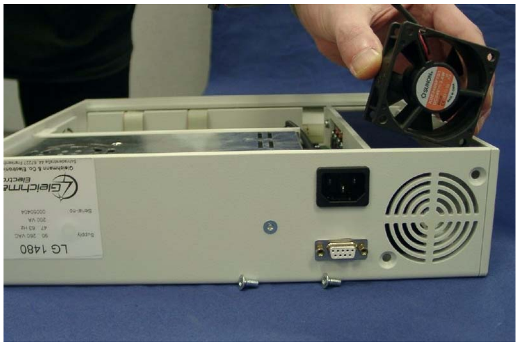
2 Lift the bottom cover up at the front and pull it off.



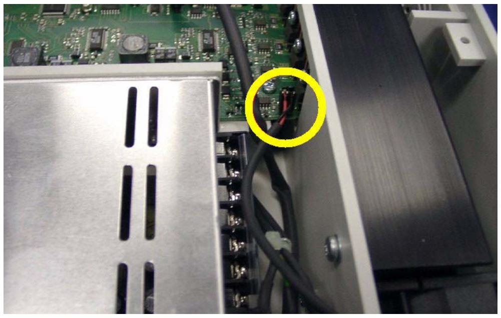
3 Unplug the fan connector from the main board.



4 Lift the fan out of the battery conditioner housing.



5 When replacing the fan make sure the connector is plugged in correctly as shown in the photograph below.



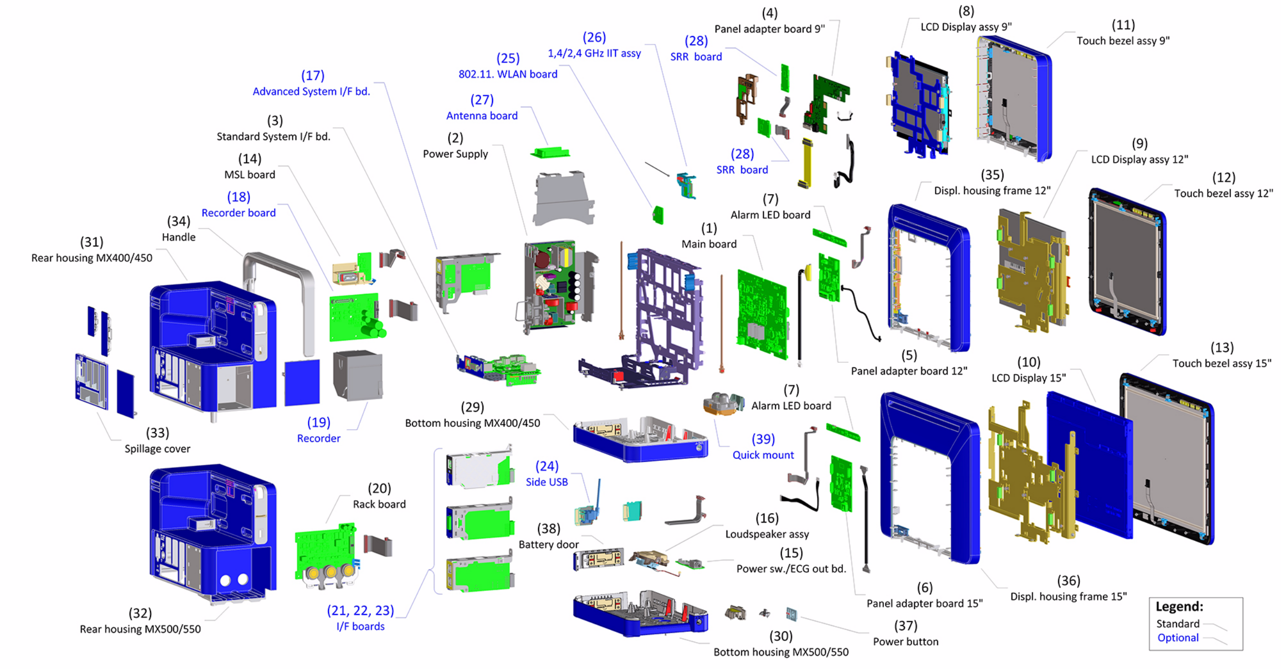
6

Parts

This section lists the replacement and exchange parts for the following Philips IntelliVue Patient Monitoring System components:

- "MX400/450/500/550 Parts" on page 218
- "Remote Control Parts" on page 225
- "Multi-Measurement Module (MMS) Parts" on page 225
- "MMS Extension Parts (M3012A, M3014A, M3015A/B)" on page 233
- "IntelliVue X2 Part Numbers" on page 235
- "Smart Battery Charger Part Numbers" on page 241

MX400/450/500/550 Parts


(26)
1,4/2,4 GHz IIT assy
(25)
802.11. WLAN board
(17)
Advanced System I/F bd.
(27)
Antenna board
(3)
Standard System I/F bd.
(2)
Power Supply
(14)
MSL board
(18)
Recorder board
(34)
Handle
(31)
Rear housing MX400/450
(33)
Spillage cover
(19)
Recorder
(29)
Bottom housing MX400/450
(24)
Side USB
(20)
Rack board
(38)
Battery door
(32)
Rear housing MX500/550
(21, 22, 23)
I/F boards
(4)
Panel adapter board 9"
(28)
SRR board
(28)
SRR board
(8)
LCD Display assy 9"
(11)
Touch bezel assy 9"
(7)
Alarm LED board
(1)
Main board
(35)
Displ. housing frame 12"
(9)
LCD Display assy 12"
(12)
Touch bezel assy 12"
(5)
Panel adapter board 12"
(10)
LCD Display 15"
(13)
Touch bezel assy 15"
(7)
Alarm LED board
(39)
Quick mount
(16)
Loudspeaker assy
(15)
Power sw./ECG out bd.
(6)
Panel adapter board 15"
(36)
Displ. housing frame 15"
(37)
Power button
(30)
Bottom housing MX500/550
Legend:
Standard
Optional

Exchange Parts

Part Number	Description	No. in Diagram
453564406331	IV2-FLEX Main board	1

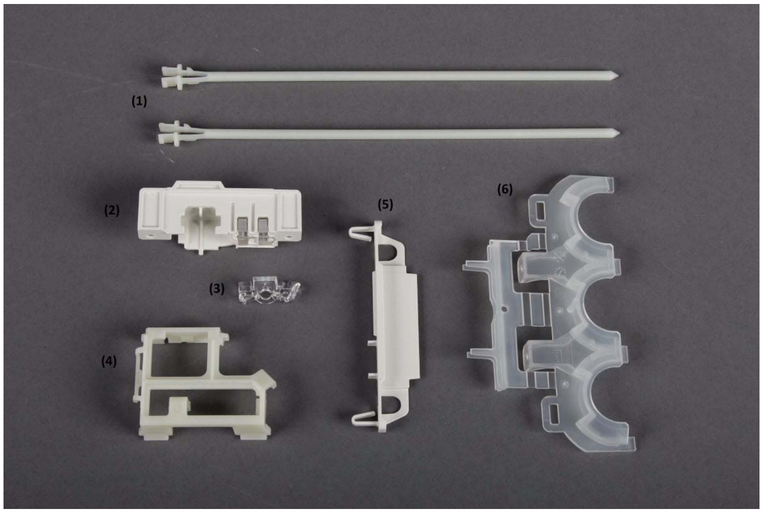
Replacement Parts

Part number	12NC	Description	Number in Diagram
453564281221	453564281221	IV2-FLEX ASSY-PWR AC/DC Power Supply	2
453564407911	453564407911	IV2-FLEX I/F; Standard System I/F board	3
453564407921	453564407921	IV2-FLEX Panel adapter board MX400	4
453564407931	453564407931	IV2-FLEX Panel adapter board MX450/500	5
453564407941	453564407941	IV2-FLEX Panel adapter board MX550	6
453564407961	453564407961	IV2-FLEX Alarm LED board MX450/500/ 550	7
453564406301	453564406301	IV2-FLEX DSPL LCD assembly MX400	8
453564406311	453564406311	IV2-FLEX DSPL LCD assembly MX450/500	9
453564406321	453564406321	IV2-FLEX DSPL LCD assembly MX550	10

Part number	12NC	Description	Number in Diagram
453564406271	453564406271	IV2-FLEX Touch bezel assembly MX400	11
453564406281	453564406281	IV2-FLEX Touch bezel assembly MX450/500	12
453564406291	453564406291	IV2-FLEX Touch bezel assembly MX550	13
453564408531	453564408531	IV2-FLEX MSL assembly with holder	14
453564407981	453564407981	IV2-FLEX Power switch/ ECG sync out bd	15
453564406631	453564406631	IV2-FLEX MECHASY Loudspeaker assembly	16
453564407901	453564407901	IV2-FLEX I/F; Advanced System I/F board	17
453564408301	453564408301	IV2-FLEX Recorder bd. assembly MX400/450	18
453564408311	453564408311	IV2-FLEX Recorder MX400/450	19
453564408291	453564408291	IV2-FLEX Rack board MX500/550	20
453564407971	453564407971	IV2-FLEX I/F; IntelliBridge board	21
453564407891	453564407891	IV2-FLEX I/F; Flexible Nurse Call	22
453564407881	453564407881	IV2-FLEX I/F; Dual MIB/RS232	23
453564408541	453564408541	IV2-FLEX Side USB cable kit	24
453564408321	453564408321	IV2-FLEX WLAN board	25
453564408341	453564408341	IV2-FLEX IIT assembly 1.4 GHz	26
453564408351	453564408351	IV2-FLEX IIT assembly 2.4 GHz	26
453564408431	453564408431	IV2-FLEX Triband antenna for IIT/WLAN	27
453564408281	453564408281	IV2-FLEX SRR board	28
453564407991	453564407991	IV2-FLEX MECHASY Bottom housng MX400/450	29
453564408001	453564408001	IV2-FLEX MECHASY Bottom housng MX500/550	30
453564408021	453564408021	IV2-FLEX MECHASY Rear housing MX400/450	31
453564408031	453564408031	IV2-FLEX MECHASY Rear housing MX500/550	32
453564408381	453564408381	IV2-FLEX Spillage cover assembly	33
453564408991	453564408991	IV2-FLEX MECHASY Handle assembly	34
453564408261	453564408261	IV2-FLEX MECHASY Display Frame MX450/500	35
453564408271	453564408271	IV2-FLEX MECHASY Display Frame MX550	36
453564409041	453564409041	IV2-FLEX KBD Power Button	37
453564408011	453564408011	IV2-FLEX MECHASY Battery door assembly	38

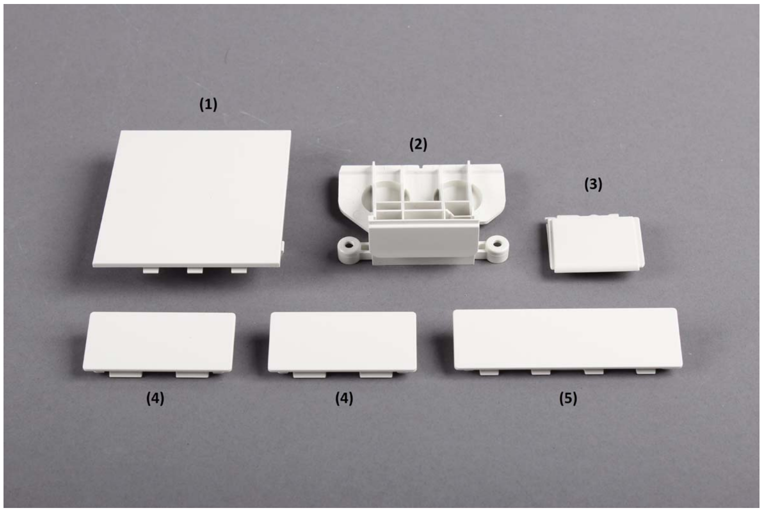
Part number	12NC	Description	Number in Diagram
453564408251	453564408251	IV2-FLEX MECHASY Quick mount	39
453564409001	453564409001	IV2-FLEX Small parts kit 1	
453564409011	453564409011	IV2-FLEX Small parts kit 2	
453564409031	453564409031	IV2-FLEX Cable kit basic	
453564415331	453564415331	IV2-FLEX Cable kit MX400	
453564415341	453564415341	IV2-FLEX Cable kit MX450/500	
453564415351	453564415351	IV2-FLEX Cable kit MX550	
453564434051	453564434051	IV2-FLEX Screw kit	
M4605A	989803135861	BATTERY 10.8V 6Ah LiIon	
453564239731	453564239731	IV2 MECHASY Table Mount Kit	

IV2-FLEX Small Parts Kit 1 (453564409001) Contents:



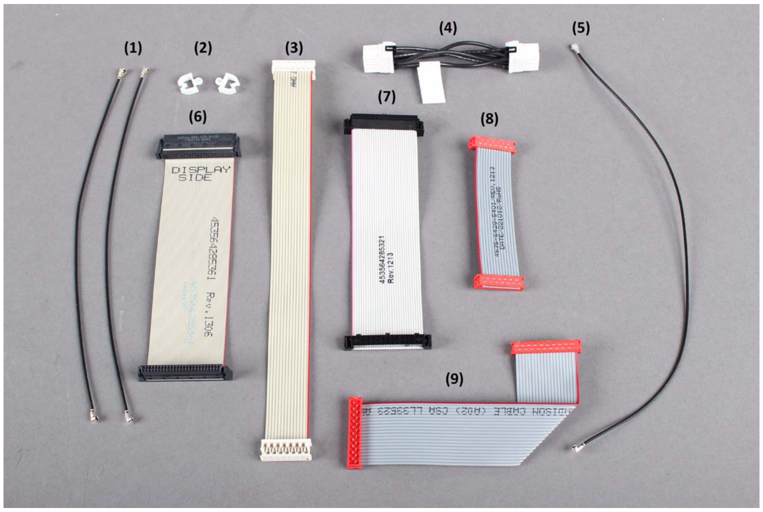
Item	Quantity	No.
Plastic Pin	2	1
Tapped-Guide	1	2
Lightguide Power-Status	1	3
Plastic Holder IIT	1	4
Ingress Protection Clamp	1	5
Plastic Holder Rack Board	1	6

IV2-FLEX Small Parts Kit 2 (453564409011) Contents:



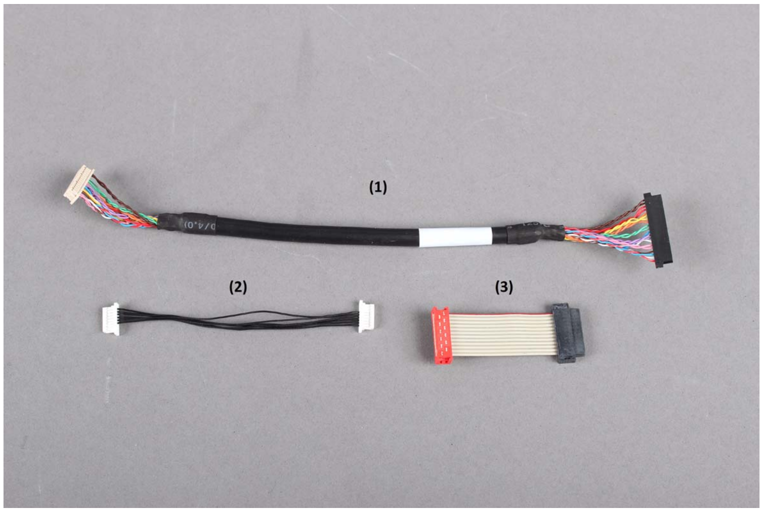
Item	Quantity	No.
Blank Cover Recorder	1	1
Blank Cover Quickmount	1	2
Blank Cover Side USB	1	3
Blank Cover I/O Boards	2	4
Blank Cover Advanced System Interface Board	1	5

IV2-FLEX Cable Kit Basic (453564409031) Contents:



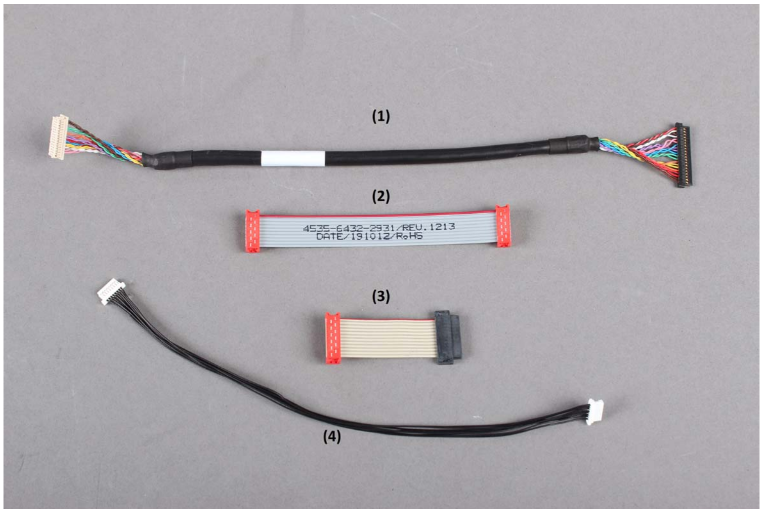
Item	Quantity	No.
Antenna Cable 802.11 WLAN	2	1
Plastic Holder Antenna Cable	2	2
Cable Power Switch/ECG Sync Out Board -> Main Board	1	3
Cable Power Supply -> Standard System Interface Board	1	4
Antenna Cable IIT	1	5
Cable Main Board -> Panel Adapter Board	1	6
Cable Main Board -> Recorder Board	1	7
Cable Main Board -> IIT Assy	1	8
Cable Main Board -> MSL Connector	1	9

IV2-FLEX Cable Kit MX400 (453564415331) Contents:



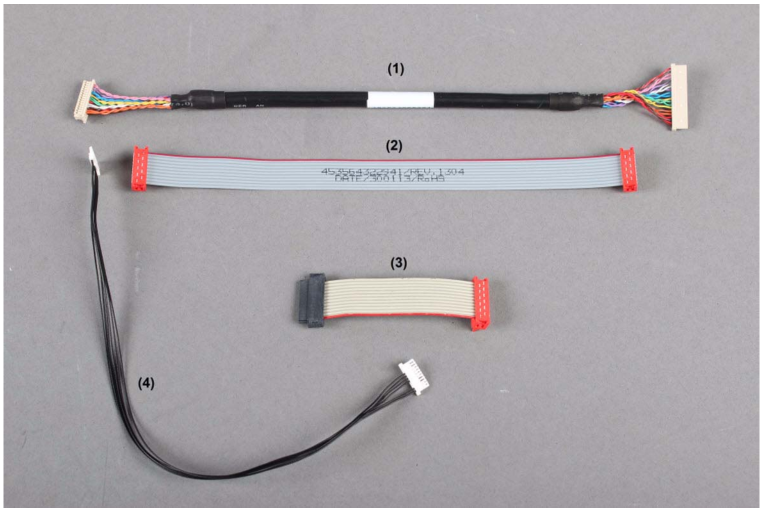
Item	Quantity	No.
Cable Main Board -> 9" Display	1	1
Cable Panel Adapter Board -> 9" LED Backlight	1	2
Cable Panel Adapter Board -> Short Range Radio Board	1	3

IV2-FLEX Cable Kit MX450/500 (453564415341) Contents:



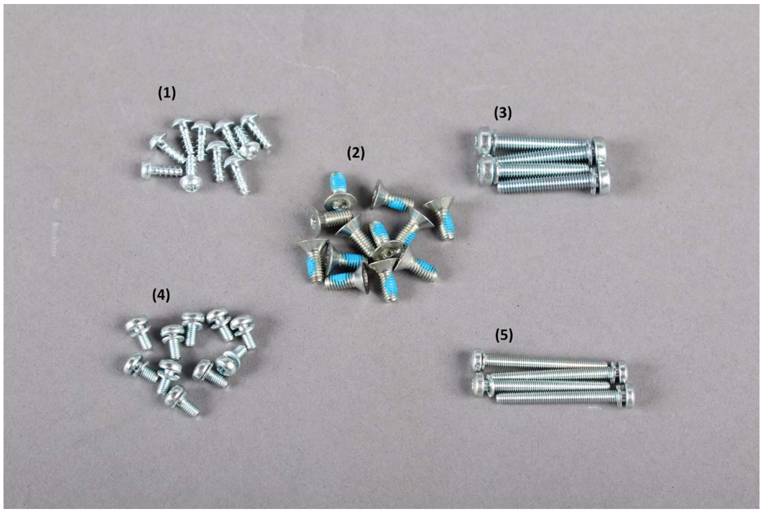
Item	Quantity	No.
Cable Main Board -> 12" Display	1	1
Cable Panel Adapter Board -> Alarm LED Board	1	2
Cable Panel Adapter Board -> Short Range Radio Board	1	3
Cable Panel Adapter Board -> 12" LED Backlight	1	4

IV2-FLEX Cable Kit MX550 (453564415351) Contents:



Item	Quantity	No.
Cable Main Board -> 15" Display	1	1
Cable Panel Adapter Board -> Alarm LED Board	1	2
Cable Panel Adapter Board -> Short Range Radio Board	1	3
Cable Panel Adapter Board -> 15" LED Backlight	1	4

IV2-FLEX Screw Kit (453564434051) Contents:



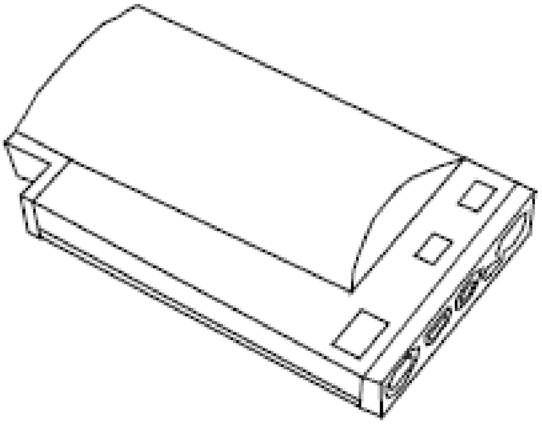
Item	Quantity	No.
Self-tapping screw M3 x 1.34 8mm long	10	1
M3 x 10 with Nylon Prelock used for Bed Hanger	12	2
M4 x 25 incl. Safety Washer used for Quick Mount	4	3
M3 x 6 incl Safety Washer	10	4
M3 x 30 incl Safety Washer used for Handle	4	5

Remote Control Parts

Part number	12NC	Description
453564212481	453564212481	IV2-RC Remote Control
453564212401	453564212401	IV2-RC PLAST Holder for Remote Control
453564212411	453564212411	IV2-RC CBL USB cable for Remote Control
453564262641	453564262641	IV2-RC CBL Tethering cable

Multi-Measurement Module (MMS) Parts

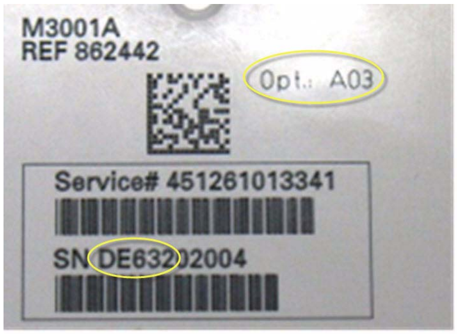
The primary support strategy for the Multi-Measurement Module is a unit exchange. However, some exchange parts are available. In order to determine which exchange parts need to be ordered check the serial number and the option string of the MMS as described below.



M3001A Multi-Measurement Module

MMS Part Number Overview and Identification

Identify the correct MMS part number by checking the serial number prefix and the option string on the label on the rear of the MMS housing. The following picture shows the label of an M3001A. Use the table below to determine the hardware revision and the required exchange part.



Option	M3001A Option Description
#A01	Philips FAST SpO^2
#A02	Nellcor OxiMax compatible (obsolete)
#A03	Masimo SET Technology
#A04	Nellcor OxiMax Technology
(#C00)	Standard
#C06	Add Pressure/Temp
#C12	Add 12 Lead ECG (only older revisions - see table below
(#C18)	(Add Pressure/Temp and 12 Lead ECG) **old**

With Rel. G.0 option #C18 is split into #C06#C12. MMS software option #A02 is obsolete and replaced by #A04. Hardware revisions A/B are out of support. If an MMS with HW Rev. A/B becomes defective, or if the customer prefers to proactively keep the MMSs in full support., the following options are available:

- Order a replacement from hardware A/B to hardware C via the service channel (Uptrade MMS).
- Order a new MMS via the sales channel.

NOTE

In order to follow the RoHS guidelines, make sure you identify and order the appropriate part. Non RoHS = Not RoHS compliant.

HW Revision	Possible MMS Software Revision	Serial Number Prefix	SW of monitor the MMS is connected to	Option String	Exchange MMS (for 12NC information please refer to tables in the following sections)
HW A	A.0 to H.0	DE227	A.0, A.1	--, C06, C12, C18, C06C12	No longer supported, see uptrade parts
		DE441	A.0, A.1	A01, A01C06, A01C12, A01C18, A01C06C12	
		DE227	>=A.2	--, C06, C12, C18, A01C06C12	No longer supported, see uptrade parts
		DE441	>=A.2	A01, A01C06, A01C12, A01C18, A01C06C12	

HW Revision	Possible MMS Software Revision	Serial Number Prefix	SW of monitor the MMS is connected to	Option String	Exchange MMS (for 12NC information please refer to tables in the following sections)
HW B	B.1 to H.0	DE441	>=A.2	A02, A02C06, A02C18, A01C06C12	No longer supported, see uptrade parts
		DE512	>=A.2	A02, A02C06, A02C18, A01C06C12	
			>=A.2	A01,A01C06, A01C12, A01C18, A01C06C12	No longer supported, see uptrade parts
HW C (Non RoHS)	D.0 to J.0	DE610 DE 632 DE717 DE907	>=A.2	A01, A01C06, A01C18, A01C06C12	M3001-68x05
				A02, A02C06, A02C18, A01C06C12	M3001-68x06
				A03, A03C06, A03C18, A01C06C12	M3001-68x07
				A04, A04C06, A04C06C12	M3001-68x06
HW C (RoHS compliant)	> J.0	DE345	> = A.2	A01, A01C06, A01C18, A01C06C12	M3001-68x15
				A03, A03C06, A03C18, A01C06C12	M3001-68x17
				A04, A04C06, A04C06C12	M3001-68x06

For further compatibility information please refer to the Software Compatibility Matrix in the Troubleshooting section.

Exchange Multi-Measurement Modules are shipped with English front bezels only. If you require a bezel in another language (compare the part numbers of your language to the English ones to check this) the front bezel has to be ordered additionally. Attach the appropriate bezel before putting the MMS into operation.

MMS Firmware

NOTE

Multi-Measurement Modules (MMS) with HW Rev. A have a fixed firmware that cannot be upgraded. HW B and HW C MMSs allow upgrading of the SpO2 and ECG firmware.

To perform a FW upgrade, the MMS must have SW Revision C.0 or higher and be connected to an IntelliVue patient monitor.

SpO2

Option	HW Revision	SpO2 FW Rev	Comment
#A01	HW A	A.01.04	The HW and its interface do not allow a FW upgrade
#A01 #A02	HW B	(A.01.41) -> A.01.46	Must be upgraded to A.01.46 - see internal Field Notification
		(A.01.42) -> A.01.47	
#A01 #A02	HW C	A.01.48	
	HW C (B.03.00)	A.04.16	Currently shipped FW
#A03	HW C	Masimo SET FW	Not upgradeable by Philips
#A04	HW C	Nellcor OxiMax FW	Philips upgradeable

ECG

Option	HW Revision	ECG FW Rev	Comment
#A01	HW A	C.00.13	The HW and its interface do not allow a FW upgrade
#A01	HW A	C.01.19	
#A01 #A02 #A03 #A04	HW B/C	D.01.70	Upgradeable - see internal Field Notifications
		D.01.76	
		D.01.77	
		D.01.78	
		D.01.89	
		D.02.02	
		D.02.05	Currently shipped FW (requires MMS SW Revision F.0)

MMS Whole Unit Exchange Part Numbers

NOTE

The MMS always ships with the latest Software Revision. In order to make it compatible with the respective monitor the MMS may need to be upgraded or downgraded. From Support Tool version

E.03.01 onwards the MMS can be up- or downgraded with every support tool license key (except general).

Part number	12NC	Description
Non RoHS, HW Rev: C; SN Prefix: DE610/DE632/DE717/DE907		
Option: A01		
M3001-68105	451261013041	MS_X1 5ld w/o P/T-Eng - HW C nRoHS
M3001-68205	451261013061	MS_X1 5ld w P/T - Eng - HW C nRoHS
M3001-68305	453564146221	MS_X1 12ld wo P/T-Eng - HW C nRoHS
M3001-68405	451261013081	MS_X1 12ld w P/T -Eng - HW C nRoHS
M3001-68505	451261013101	MS_X1 5ld w/o P/T-Sym - HW C nRoHS
M3001-68605	451261013121	MS_X1 5ld w P/T -Sym - HW C nRoHS
M3001-68705	453564146241	MS_X1 12ld w/o P/T-Sym- HW C nRoHS
M3001-68805	451261013141	MS_X1 12ld w P/T - Sym - HW C nRoHS
Option: A04		
M3001-68106	451261013161	MS_X1 5ld w/o P/T-Eng - Nellcor
M3001-68206	451261013181	MS_X1 5ld w P/T -Eng - Nellcor
M3001-68306	453564146171	MS_X1 12ld wo P/T -Eng- Nellcor
M3001-68406	451261013201	MS_X1 12ld w P/T -Eng - Nellcor
M3001-68506	451261013221	MS_X1 5ld w/o P/T-Sym - Nellcor
M3001-68606	451261013241	MS_X1 5ld w P/T -Sym - Nellcor
M3001-68706	453564146181	MS_X1 12ld wo P/T -Sym- Nellcor
M3001-68806	451261013261	MS_X1 12ld w P/T -Sym - Nellcor
Option: A03		
M3001-68107	451261013281	MS_X1 5ld w/o P/T-Eng-Masimo-HWC nRoHS
M3001-68207	451261013301	MS_X1 5ld w P/T-Eng-Masimo-HWC nRoHS
M3001-68307	453564146301	MS_X1 12ld wo P/T-Eng - Masimo HWC nRoHS
M3001-68407	451261013321	MS_X1 12ld w P/T -Eng-Masimo-HWC nRoHS
M3001-68507	451261013341	MS_X1 5ld w/o P/T-Sym-Masimo-HWC nRoHS
M3001-68607	451261013361	MS_X1 5ld w P/T -Sym-Masimo-HWC nRoHS
M3001-68707	453564146321	MS_X1 12ld w/o P/T-Sym- Masimo-HWC nRoHS
M3001-68807	451261013381	MS_X1 12ld w P/T - Sym-Masimo-HWC nRoHS
RoHS compliant, HW Rev: C; SN Prefix DE345		
Option: A01		
M3001-68115	453564453341	MS_X1 5ld w/o P/T-Eng - HW C
M3001-68215	453564453361	MS_X1 5ld w P/T - Eng - HW C
M3001-68315	453564453381	MS_X1 12ld wo P/T-Eng - HW C
M3001-68415	453564453401	MS_X1 12ld w P/T -Eng - HW C
M3001-68515	453564453431	MS_X1 5ld w/o P/T-Sym - HW C

Part number	12NC	Description
M3001-68615	453564453481	MS_X1 5ld w P/T -Sym - HW C
M3001-68715	453564453501	MS_X1 12ld w/o P/T-Sym- HW C
M3001-68815	453564453521	MS_X1 12ld w P/T - Sym - HW C
Option: A04		
M3001-68106	451261013161	MS_X1 5ld w/o P/T-Eng - Nellcor
M3001-68206	451261013181	MS_X1 5ld w P/T -Eng - Nellcor
M3001-68306	453564146171	MS_X1 12ld wo P/T -Eng- Nellcor
M3001-68406	451261013201	MS_X1 12ld w P/T -Eng - Nellcor
M3001-68506	451261013221	MS_X1 5ld w/o P/T-Sym - Nellcor
M3001-68606	451261013241	MS_X1 5ld w P/T -Sym - Nellcor
M3001-68706	453564146181	MS_X1 12ld wo P/T -Sym- Nellcor
M3001-68806	451261013261	MS_X1 12ld w P/T -Sym - Nellcor
Option: A03		
M3001-68117	453564453351	MS_X1 5ld w/o P/T-Eng-Masimo-HWC
M3001-68217	453564453371	MS_X1 5ld w P/T-Eng-Masimo-HWC
M3001-68317	453564453391	MS_X1 12ld wo P/T-Eng - Masimo HW C
M3001-68417	453564453411	MS_X1 12ld w P/T -Eng-Masimo-HWC
M3001-68517	453564453441	MS_X1 5ld w/o P/T-Sym-Masimo-HWC
M3001-68617	453564453491	MS_X1 5ld w P/T -Sym-Masimo-HWC
M3001-68717	453564453511	MS_X1 12ld w/o P/T-Sym- Masimo-HWC
M3001-68817	453564453531	MS_X1 12ld w P/T - Sym-Masimo-HWC
Upgrade MMS (HW A/B to HW C)		
M3001-60109	453564380641	MS_X1 5ld wo P/T Eng HWA/B > HWC New
M3001-60209	453564380651	MS_X1 5ld w P/T Eng HWA/B > HWC New
M3001-60309	453564380661	MS_X1 12ld wo P/T Eng HWA/B > HWC New
M3001-60409	453564380671	MS_X1 12ld w P/T Eng HWA/B > HWC New
M3001-60509	453564380681	MS_X1 5ld wo P/T Sym HWA/B > HWC New
M3001-60609	453564380691	MS_X1 5ld w P/T Sym HWA/B > HWC New
M3001-60709	453564380701	MS_X1 12ld wo P/T Sym HWA/B > HWC New
M3001-60809	453564380711	MS_X1 12ld w P/T Sym HWA/B > HWC New

NOTE

nRoHS=nonRoHS

MMS Exchange Parts - PCAs

Part number	12NC	Description
Non RoHS HW Rev: C; SN Prefix: DE610/DE632/DE717/DE907		
M3001-68557	451261020751	MS_X1 PCA ECG-5ld/Fast SpO2 nRoHS
453564186021	453564186021	MS_X1 PCA ECG-5ld/Fast SpO2/w PT nRoHS
M3001-68553	451261020771	MS_X1 PCA ECG-5ld/Masimo SpO2 nRoHS
453564186051	453564186051	MS_X1 PCA ECG-5ld/Masimo SpO2/w PT nRoHS
M3001-68555	451261020791	MS_X1 PCA ECG-5ld / Nellcor SpO2 nRoHS
453564186081	453564186081	MS_X1 PCA ECG-5ld/NellcorSpO2/w PT nRoHS
M3001-68425	453564177921	MS_X1 Main board for HW C nRoHS
RoHS compliant Hw Rev: C; SN Prefix DE345		
M3001-68757	453564453471	MS_X1 PCA ECG-5ld/Fast SpO2
453564434611	453564434611	MS_X1 PCA ECG-5ld/Fast SpO2/w PT
M3001-68753	453564453451	MS_X1 PCA ECG-5ld/Masimo SpO2
453564434621	453564434621	MS_X1 PCA ECG-5ld/Masimo SpO2/w PT
M3001-68755	453564453461	MS_X1 PCA ECG-5ld / Nellcor SpO2
453564434631	453564434631	MS_X1 PCA ECG-5ld/Nellcor SpO2/w PT
M3001-68725	453564453421	MS_X1 Main board for HW C

MMS Replacement Parts

Part number	12NC	Description
M3000-66541	453564107971	MS_X1 PCA DC/DC Board for HW A/B
453564474391	453564474391	MS_X1 MSL Flex Assembly
5041-8114	453563100081	MS_X1 Mounting Pin
M3001-64500	451261020561	MS_X1 NBP Assembly for X1/X2/MP2
453564423471	453564423471	MS_X2 CONN NiBP Inlet X1/X2/MP2/MP5(5ea)
453564270591	453564270591	MS_X1 Housing Bottom MMS HW A/B
453564187321	453564187321	MS_X1 Housing Bottom MMS HW C & MSE
M3081-61601	453563402721	CBL MSL 1m

MMS Part Numbers - Top Covers

Part number	12NC	Description
M3001-68010	451261016401	MS_X1 Top Cover 5ld w/o P/T Text FAST
M3001-68011	451261016411	MS_X1 Top Cover 5ld w P/T Text FAST
M3001-68012	451261016421	MS_X1 Top Cover 12ld w/o P/T Text FAST

Part number	12NC	Description
M3001-68013	451261016431	MS_X1 Top Cover 12ld w P/T Text FAST
M3001-68014	451261016441	MS_X1 Top Cover 5ld w/o P/T Sym FAST
M3001-68015	451261016451	MS_X1 Top Cover 5ld w P/T Sym FAST
M3001-68016	451261016461	MS_X1 Top Cover 12ld w/o P/T Sym FAST
M3001-68017	451261016471	MS_X1 Top Cover 12ld w P/T Sym FAST
M3001-68018	451261016481	MS_X1 Top Cover 5ld w/o P/T Text NELLCOR
M3001-68019	451261016491	MS_X1 Top Cover 5ld w P/T Text NELLCOR
M3001-68020	451261016501	MS_X1 Top Cover 12ld w P/T Text NELLCOR
M3001-68021	451261016511	MS_X1 Top Cover 5ld w/o P/T Sym NELLCOR
M3001-68022	451261016521	MS_X1 Top Cover 5ld w P/T Sym NELLCOR
M3001-68023	451261016531	MS_X1 Top Cover 12ld w P/T Sym NELLCOR
M3001-68030	453564147051	MS_X1 TopCover 12ld w/o P/T Text NELLCOR
M3001-68031	453564147061	MS_X1 Top Cover 12ld w/o P/T Sym NELLCOR
M3001-68024	451261016541	MS_X1 Top Cover 5ld w/o P/T Text MASIMO
M3001-68025	451261016551	MS_X1 Top Cover 5ld w P/T Text MASIMO
M3001-68026	451261016561	MS_X1 Top Cover 12ld w P/T Text MASIMO
M3001-68027	451261016571	MS_X1 Top Cover 5ld w/o P/T Sym MASIMO
M3001-68028	451261016581	MS_X1 Top Cover 5ld w P/T Sym MASIMO
M3001-68029	451261016591	MS_X1 Top Cover 12ld w P/T Sym MASIMO
M3001-68032	453564147071	MS_X1 Top Cover 12ld w/o P/T Text MASIMO
M3001-68033	453564147081	MS_X1 Top Cover 12ld w/o P/T Sym MASIMO

MMS Part Numbers - Front Bezels

Part number	12NC	Description	Options
451261024391	451261024391	MS_X1 Bezel w/o P/T Eng. Text	#A01, #A03
451261024401	451261024401	MS_X1 Bezel w P/T Eng. Text	#A01 #A03
451261024411	451261024411	MS_X1 Bezel w/o P/T Symbols	#A01 #A03
451261024421	451261024421	MS_X1 Bezel w P/T Symbols	#A01 #A03
451261024431	451261024431	MS_X1 Bezel Nellcor w/o P/T Eng. Text	#A02 #A04
451261024441	451261024441	MS_X1 Bezel Nellcor w P/T Eng. Text	#A02 #A04
451261024451	451261024451	MS_X1 Bezel Nellcor w/o P/T Symbols	#A02 #A04
451261024461	451261024461	MS_X1 Bezel Nellcor w P/T Symbols	#A02 #A04

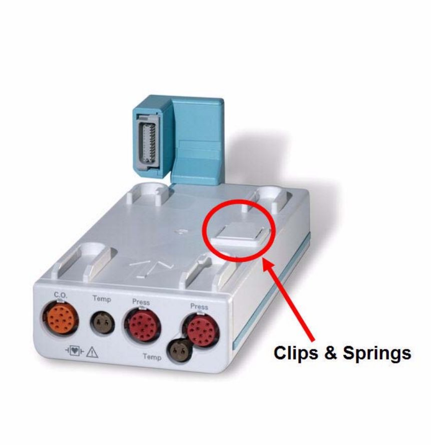
MMS Extension Parts (M3012A, M3014A, M3015A/ B)

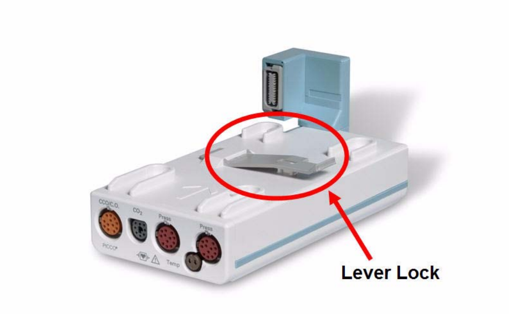
Exchange MMS Extensions are shipped with English front bezels only. If you require a bezel in another language (compare the part numbers of your language to the English ones to check this) the front bezel has to be ordered additionally. Attach the appropriate bezel before putting the MMS extension into operation.

The part numbers in the following parts table below, are used to order parts from your Philips representative.

MMS Extension General Support Parts

Part number	12NC	Description	Comments
M3014-64200	451261012731	MS_RCO2 MMS Ext Clips+Springs, 10ea	Old top housing
M3012-64600	451261012721	MS_HMS MMS Ext. Lever Locks (5ea)	Grey lever release mechnanism
M3012-64620	451261016601	MS_HMS MSE Top Cover Assy	
M3012-64621	451261016611	MS_HMS MSE Link Bar Assy	Without Flex, must be ordered separately
453564088851	453564088851	MS_MCO2 Flex Cable/Connector Assy	
5041-8114	453563100081	MS_X1 Mounting Pin	





MMS Extension Front Bezels and Accessories

Part number	12NC	Description
M3012A BEZELS		
451261024471	451261024471	MS_HMS Bezel P, T, P/T Eng. Text

Part number	12NC	Description
451261024481	451261024481	MS_HMS Bezel P, T, P/T Symbols
451261024491	451261024491	MS_HMS Bezel C.O.,P, T, P/T Eng. Text
451261024501	451261024501	MS_HMS Bezel C.O.,P, T, P/T Symbols
451261024511	451261024511	MS_HMS Bezel CCO,C.O.,P,T,P/T Eng Text
451261024521	451261024521	MS_HMS Bezel CCO, C.O.,P,T,P/T Sym
M3012A Misc		
14454A	453563057651	I.V POLE MOUNT
M3014A Bezels		
451261024531	451261024531	MS_RCO2 Bezel CO2 only Eng. Text/Sym
451261024541	451261024541	MS_RCO2 Bezel C.O., CO2,P,P/T Eng. Text
451261024551	451261024551	MS_RCO2 Bezel C.O., CO2, P, P/T Symbols
451261024561	451261024561	MS_RCO2 Bezel CO2, P, P/T Eng. Text
451261024571	451261024571	MS_RCO2 Bezel CO2, P, P/T Symbols
451261024581	451261024581	MS_RCO2 Bezel C.O., CCO,CO2,P,P/T Text
451261024591	451261024591	MS_RCO2 Bezel C.O.,CCO, CO2, P, P/T Sym
Canpnograhpy Sensors		
M2741-68000	451261011291	SNSR M2741A Sidestream Sensor
M2501-68000	451261006391	MS_MCO2 M2501A Mainstream Sensor
M2741-60000	451261011731	Mounting Bracket Replacement
M3015A Bezel		
451261024601	451261024601	MS_SCO2 Bezel CO2 w P/T Eng. Text
451261024611	451261024611	MS_SCO2 Bezel CO2 w P/T Symbols
451261024621	451261024621	MS_SCO2 Bezel CO2 w/o P/T Eng. Text
451261024631	451261024631	MS_SCO2 Bezel CO2 w/o P/T Symbols
M3015A Misc		
453564312801	453564312801	MS_SCO2 Housing Bottom HW Rev A,B
M3015B Bezel		
453564270051	453564270051	MS_SCO2 Bezel Symbols M3015B CO2. P, P, T
453564270061	453564270061	MS_SCO2 Bezel Text M3015B CO2. P, P, T
M3015B Misc		
453564312871	453564312871	MS_SCO2 Top Cover Assy HW Rev C

Exchange Parts List

Exchange parts are parts that have been returned to Philips and reconditioned for further use. Parts offered as exchange parts are in excellent service order according to rigorous Philips standards but offer you a considerable price advantage.

A front bezel with symbols instead of English text is provided with each exchange MMS Extension.

Part number	12NC	Description
M3012A	**862111**	**Hemodynamic Measurement Server Extension**
M3012-6801A	451261000201	MS_HMS OEM EXCH.UNIT ENGLISH (#C00)
M3012-6831A	451261000341	MS_HMS OEM EXCH.UNIT ENGLISH (#C05)
M3012-6861A	451261000491	MS_HMS OEM EXCH.UNIT ENGLISH (#C10)
M3014A	**862187**	**Capnography extension**
M3014-6801A	451261009281	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C00)
M3014-6831A	451261009311	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C05)
M3014-6861A	451261009601	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C10)
M3014-6891A	451261009461	MS_RCO2 OEM EXCH.UNIT ENGLISH (#C07)
M3015A	**862393**	**Microstream CO2 Extension**
M3015-6802A	451261005311	MS_SCO2 M3015A Unit with P/T (HW Rev. B)
M3015-6832A	451261005331	MS_SCO2 M3015A Unit wo P/T (HW Rev. B)
453564293881	453564293881	MS_SCO2 OEM Exch. Unit with P/T (HW Rev. C)
453564293891	453564293891	MS_SCO2 Exch. Unit without P/T (HW Rev. C)
M3015B	**865377**	**Microstream CO2 Extension**
453564270041	453564270041	MS_SCO2 M3015B with CO2,P, P and T
453564312871	453564312871	MS_SCO2 Top Cover Assy HW Rev C

IntelliVue X2 Part Numbers

Please refer to the IntelliVue X2 Service Guide for IntelliVue X2 part numbers.

Plug-in Modules Part Numbers

For inspection procedures; preventive maintenance procedures; cleaning procedures; maintenance, and good practices used to maintain the instrument in good working order, see *Testing and Maintenance*.

Part number	12NC	Description
M1001-45011	453563490691	M_ECG PLAST SNAP LOCK SINGLE
5040-4247	453563099401	PLAST Snap Lock (CV color)

M1006B Invasive Blood Pressure Module

Part number	12NC	Description
Exchange Parts		
Non RoHS DOM (Date Of Manufacture) < 2014-03 OR No DOM is present		
Modules		
M1006-69601	453563463061	M_PRS IBP Module ENG, nRoHS
M1006-69602	453564463261	M_PRS IBP Module Symbol Multilang, nRoHS
Modules with analog out		
M1006-69651	453563463071	M_PRS IBP Module ENG, w.Analog-out nRoHS
M1006-69652	453564463281	M_PRS IBP Mod C01 Symbol Multilang nRoHS
RoHS compliant DOM ≥ 2014-03		
Modules		
M1006-69701	453564453101	M_PRS IBP Module ENG
M1006-69702	453564463301	M_PRS IBP Module Symbol Multilang
Modules with analog out		
M1006-69751	453564453131	M_PRS IBP Module ENG, w. Analog-out
M1006-69752	453564463321	M_PRS IBP Mod C01 Symbol Multilang
Replacement Parts		
Front Housings		
M1006-60201	453563462101	M_PRS Frt Housg IBP, ENG
M1006-60202	453564463341	M_PRS Frt Housg IBP, Symbol Multilang
Front Housings with analog out		
M1006-60251	453563462091	M_PRS Frt Housg IBP C01, ENG
M1006-60252	453564463351	M_PRS Frt Housg IBP C01,Symbol Multilang
Bezel		
M1006-42202	453563463211	M_PRS PLAST Bezel Press-Square
Cables		
M1006-61689	453563225911	M_PRS CBL ADPTR M1006B#C01 1/4" phone JK

M1011A Intravascular Oxygen Saturation Module

Part number	12NC	Description
453564120301	453564120301	M_SO2 Module Exchange, ENG
453564120311	453564120311	M_SO2 Module Exchange, SYMBOLS

Part number	12NC	Description
453564105801	453564105801	M_SO2 Front Housing Assy SO2 ENGLISH
453564105811	453564105811	M_SO2 Front Housing Assy SO2 SYMBOL
M1011-42201	453564120341	M_SO2 Bezel
989803151591	989803151591	SO2 Optical Module
453564097201	453564097201	M_SO2 OEM Exchange SO2 Optical Module

M1012A Cardiac Output Parameter Module

Part number	12NC	Description
Non ROHS, DOM (Date Of Manufacture) < 2014-05 OR No DOM is present		
Modules		
M1012-69601	453563458801	M_CO Module C.O., ENG nRoHS
M1012-69604	453564463371	M_CO Module C.O., Symbol Multilang nRoHS
Modules with PICCO		
M1012-69651	453563463011	M_CO Module C10 PiCCO, ENG nRoHS
M1012-69654	453564463391	M_CO Module PiCCO Symbol Multilang nRoHS
RoHS Compliant, DOM ≥ 2014-05		
Modules		
M1012-69701	453564453161	M_CO Module C.O., ENG
M1012-69704	453564463411	M_CO Module C.O., Symbol Multilang
Modules with PICCO		
M1012-69751	453564453191	M_CO Module C10 PiCCO, ENG
M1012-69754	453564463431	M_CO Module PiCCO, Symbol Multilang
Replacement Parts		
Front Housings		
M1012-60201	453563462021	M_CO Frt Housg CO, ENG
M1012-60204	453564463451	M_CO Frt Housg CO, Symbol Multilang
Front Housings with PICCO		
M1012-60251	453563462031	M_CO Frt Housg C10 PiCCO, ENG
M1012-60254	453564463461	M_CO Frt Housg C10 PiCCO Symbol Multilang
Bezel		
M1012-42201	453563463241	M_CO PLAST Bezel CO Module

M1014A Spirometry Module

Part number	12NC	Description
M1014-69601	451261014451	M_SPR Module Spiro, Eng
M1014-69602	451261014461	M_SPR Module Spiro, Symbol
Front housing		
M1014-60201	451261014491	M_SPR Frt Housg Assy Spiro, ENG
M1014-60202	451261014501	M_SPR Frt Housg Assy Spiro, SYMBOL
Bezel		
M1014-42201	451261014511	M_SPR PLAST Bezel Spiro
Misc		
M1014-64100	451261014521	M_SPR TUBING Leak Test Kit Spiro

M1020B Pulse Oximetry Module

Part number	12NC	Description
M1020-69651	451261000061	M_SpO2 M1020B Philips/FAST
M1020-60251	451261000081	M_SpO2 Frt Housg Assy M1020B PhilipsFAST
M1020-66514	453564119121	M_SpO2 PCA PS2+
M1020-42211	453564458841	Bezel SpO2 Module
OxiMax Compatible Module		
M1020-69652	451261000101	M_SpO2 M1020B NELLCOR Oxi
M1020-60252	451261000121	M_SpO2 Frt Housg Assy M1020B NELLCOR
Masimo SET Module		
M1020-69653	451261000131	M_SpO2 OEM M1020B Masimo
Nellcor OxiMax Module		
453564307951	453564307951	M_SpO2 M1020B-Nellcor

M1027A EEG Module

Part number	12NC	Description
M1027-69601	453563459151	M_EEG M1027A Exch, all Lang ex Jap&Gre
M1027-69610	453563459161	M_EEG M1027A EEG Exch, JAP
M1027-69615	453563460481	M_EEG M1027A EEG Exch, Greek
M1027-60201	453563461471	M_EEG Frt Housg Assy EEG, ENG
M1027-60210	453563462131	M_EEG Frt Housg Assy EEG, JAP
M1027-60215	453563462141	M_EEG Frt Housg Assy EEG, GRK

Part number	12NC	Description
M1027-42201	453563463611	M_EEG PLAST Plast Bezel

M1029A Temperature Module

Part number	12NC	Description
Non ROHS, DOM (Date Of Manufacture) < 2014-05 OR No DOM is present		
Modules		
M1029-69601	453563459291	M_TMP Temp Module ENG nRoHS
M1029-69602	453564463481	M_TMP Temp Module Symbol Multilang nRoHS
RoHS Compliant, DOM ≥ 2014-05		
Modules		
M1029-69701	453564453281	M_TMP Temp Module ENG
M1029-69702	453564463511	M_TMP Temp Module Symbol Multilang
Replacement Parts		
Front Housings		
M1029-60201	453563461451	M_TMP Frt Housg Temp, ENG
M1029-60202	453564463471	M_TMP Frt Housg Temp, Symbol Multilang
Bezel		
M1029-42201	453563463631	M_TMP PLAST Temp Module Bezel

M1116B Thermal Array Recorder Module

Part number	12NC	Description
M1116-68603	453563466701	2" RECDR ECMS EXCH ENGLISH
M1116-68604	453563466711	2" RECDR ECMS EXCH GERMAN
M1116-68605	453563466721	2" RECDR ECMS EXCH SPANISH
M1116-68606	453563466731	2" RECDR ECMS EXCH FRENCH
M1116-68607	453563466741	2" RECDR ECMS EXCH SWEDISH
M1116-68608	453563466751	2" RECDR ECMS EXCH CHINESE
M1116-68609	453563466761	2" RECDR ECMS EXCH JAPANESE
M1116-68610	453563466771	2" RECDR ECMS EXCH ITALIAN
M1116-68620	453563466781	2" RECORDER ECMS EXCH FINNISH
M1116-68621	453563466791	2" RECORDER ECMS EXCH PORT
Front housing		
M1116-60203	453563462301	PLAST Front Housing English

Part number	12NC	Description
M1116-60204	453563489221	PLAST Front Housing German
M1116-60205	453563462311	PLAST Front Housing Spanish
M1116-60206	453563462321	PLAST Front Housing French
M1116-60207	453563489231	PLAST Front Housing Swedish
M1116-60208	453563462331	PLAST Front Housing Chinese
M1116-60209	453563462341	PLAST Front Housing Japanese
M1116-60210	453563462351	PLAST Front Housing Italian
M1116-60220	453563489241	PLAST Front Housing Finnish
M1116-60221	453563489251	PLAST Front Housing Assembly Portuguese
M1116-60301	453563243911	HSG Rear DBL (CV COLOR
M1116-80040	453563244171	PLAST Left Half Chassis
M1116-80230	453564017111	PLAST Right Half Chassis
5040-4255	453563099431	PLAST Housing Double Module
5040-4256	453563099441	PLAST Housing Double Module
M1116-40041	453563243811	Housing Top (CV color)
M1116-40230	453563243851	PLAST Front Housing English
M1116-40240	453563243861	Front Door (CV color)
1500-0802	453563059491	MECH Flat Belt
1810-1339	453563064911	ASSY Thermal Print Head
M1116-00030	453563243781	MET Spring Leaf
M1116-40060	453563243821	MACH Timing Pulley
M1116-40070	453563243831	MECHASY Drive Roller
M1116-40095	453563243841	SWITCH CAP EXTENDER
M1116-41050	453563243871	STAMPING Buff Cam
M1116-60200	453563243881	EMCH Drive Motor
M1116-60201	453563243891	Printhead Cleaning Kit
M1116-83002	453563244191	LBL Inside Door
M1001-60620	453563224011	M_ECG PLAST RECORDER FRONT ASSY, BLANK
0515-0890	453563480701	SCRW MACH M3 X 0.5 6MM-LG 90-DEG-FLH-HD

M1116C Recorder Module

These parts are exclusively for M1116C

Part number	12 NC	Description
453564452831	453564452831	M_REC Recorder Module Text
453564452841	453564452841	M_REC Recorder Module Symbol
Support Parts		
453564456821	453564456821	M_REC MECHASY Roller

Part number	12 NC	Description
453564456791	453564456791	M_REC PLAST Snap Lock kit (2ea)

865115 IntelliBridge EC10 Module

Part number	12NC	Description
453564116661	453564116661	IB-EC10 Module RS232/LAN
453564116931	453564116931	IB-EC10 Frt Housg Assy Module RS232/LAN
M1031-42201	453564116891	IB-EC10 Bezel RJ45

865383 NMT Module

Part number	12NC	Description
453564279141	453564279141	M_NMT Module NMT, Eng
453564279161	453564279161	M_NMT Module NMT, Intl
453564257851	453564257851	M_NMT PLAST Bezel
453564279181	453564279181	M_NMT Frt Housg Assy NMT, Eng
453564279191	453564279191	M_NMT Frt Housg Assy NMT, Intl
989803174581	989803174581	CBL NMT Patient Cable*
453564464081	453564464081	M_NMT CBL IntelliVue NMT Patient Cable

* Not orderable via SPS. Must be ordered through Supplies.

Smart Battery Charger Part Numbers

Part number	12NC	Description
M8043-68000	453563498911	BAT Smart Battery Conditioner (LG1480)
M8043-60010	451261001281	EMCH Repl Kit 2 Air-Fan+2 Filter-Mats
M8043-60011	451261001291	FLTR Repl. Kit: 2 Filter-Mats

External Display Part Numbers

Part number	12NC	Description
865299	**865299**	**19 in. TFT Touch (S)XGA Display**
453564116741	453564116741	ASSY-PWR - E539821 Power Brick - 12V
453564179151	453564179151	IV DSPL 19" Medical Grade w Touch
M8031-64001	451261001931	IV ASSY Pwr Supply Holder 15”/19” displ

Test and Service Tools

Table 3 UTP LAN Crossover

Part number	12NC	Description
M3199-60101	453563337371	PIC CBL NI 3FT CROSSOVER UTP
M3199-60102	453563337381	NI CBL UTP Crossover 12ft

Table 4 Grounding

Part number	12NC	Description
8120-4808	453563199211	CMS CBL EXT GND ASSY (gnd lug con)
8120-2961	453563198651	CMS CBL EXT GND ASSY(Crocodile clip)

Table 5 Test Cables

Part number	12NC	Description
453564331451	453564331451	CBL NMT Safety Test
451261026081	451261026081	CBL Safety Test ECG
451261026141	451261026141	CBL Safety Test IBP
451261026071	451261026071	CBL Safety Test M1006A/B #C01 Phone Jack
451261026041	451261026041	CBL Safety Test SpO2 (MMS/M1020B)
451261026171	451261026171	CBL Safety Test C.O.
451261026091	451261026091	CBL Safety Test EEG
451261026131	451261026131	CBL Safety Test Temp
451261026031	451261026031	CBL Safety Test CO2 (M3014A)
453564127781	453564127781	CBL Safety Test IntelliBridge
453564127771	453564127771	CBL Cable AY. ScvO2
M1012-61601	453563227731	M_CO CONN Test Adapter Cardiac Output

Table 6 Capnography - Respironics Mainstream

Part number	12NC	Description
M2506A		GAS Verification Gas
M2505A		GAS CYLINDER REGULATOR

Table 7 Capnography - Respironics Sidestream

Part number	12NC	Description
M2267A	989803106081	Calibration Regulator

Part number	12NC	Description
13907A	989803100361	Calibration Tube Assembly
M2506A		GAS Verification Gas
M2776A		Straight Sample Line

Table 8 Capnography - Microstream Oridion

Part number	12NC	Description
15210-64010	989803100841	GAS Cal 1 cylinders for TCPC02, 6/bx.
15210-64020	989803100851	GAS Cal 2 Cylinders for TCPC02, 6/bx.
M2267A	989803106081	Calibration Regulator
M3015-47301	989803143081	MS_SCO2 LBSPLY Calibration Line
13907A	989803100361	Calibration Tube Assembly
453564178121	453564178121	M_AGM Flowmeter TSI
M1013-64002	451261014851	M_G1 IV G1/G5 Leakage Test Kiter)
M1026-60146	453563467211	M_AGM TUBING WT-MANIFOLD SEALS (10ea)

7

Installation Instructions

The information contained in this chapter should enable the MX400/450/500/550 to be installed ready for use (the preparation and planning should be adhered to as specified in the *Site Preparation* section). Configuration of the system is explained in the Configuration Guide.

Installation should be carried out by qualified service personnel, either by the hospital's biomedical department, or by Philips Support.

The monitor is suitable for use in all medically used rooms which fulfill the requirements regarding electrical installation according to IEC60364-7-710 "Requirements for special installations or locations- Medical locations, or corresponding local regulations.

For mechanical and electrical installation, you need technically qualified personnel with a knowledge of english. Additionally, for monitor configuration, you need clinically qualified personnel with a knowledge of the use environment.

As the first step in preparing the monitor for use, follow the installation instructions given in this chapter.

Electromagnetic Emissions

The monitor is suitable for use in the electromagnetic environment specified in the table below. You must ensure that it is used in such an environment.

Emissions test	Compliance	Avoiding Electromagnetic Interference
Radio Frequency (RF) emissions	Group 1	The monitor uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment
RF emissions CISPR 11	Class A	The monitor is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes
Harmonic emissions IEC 61000-3-2	n/a	
Voltage fluctuations IEC 61000-3-3	n/a	

WARNING

The monitor should not be used next to or stacked with other equipment. If you must stack the monitor, you must check that normal operation is possible in the necessary configuration before you start monitoring patients.

Installation Checklist

Use this checklist to document your installation. Please file this installation record

Step	Task	Check Box when Task Done
1	Perform initial inspection of delivery, unpack and check the shipment	o
2	Mount the monitor as appropriate for your installation	o
3	Connect the monitor to AC mains using the supplied power cord	o
4	Perform Visual, Power On and Functional test blocks	o
5	Perform Safety Tests, if required by local laws and regulations	o
6	Load paper into the recorder, if present	o
7	Check/set the time and date	o
8	Check that the country-specific default settings are appropriate	o
9	Perform System Test as necessary	o

Unpacking the Equipment

Your equipment will arrive in a carton similar to the ones pictured below. All components of the monitoring system are consolidated into a single packing crate. The user documentation is provided in a separate package. The contents of the monitoring system crate depend on the options you have purchased. In addition to the monitor it can contain the following:

- MMS and user manuals
- Parameter modules
- MMS Extensions and accessories

In the unlikely event of a defect on arrival, please keep the packing materials until you have completed the initial inspection.

Initial Inspection

Mechanical Inspection

Open the shipping container(s) and examine each part of the instrument for visible damage, such as broken connectors or controls, or scratches on the equipment surfaces. If the shipping carton/ container is undamaged, check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. This may be necessary to support claims for hidden damage that may only become apparent during subsequent testing.

Electrical Inspection

The instrument has undergone extensive testing prior to shipment. Safety testing at installation is not required (except in situations where devices are interconnected forming a system, see *Connecting Non-Medical Devices* in the Site Preparation Chapter of this manual). An extensive self check may be performed. This recommendation does not supersede local requirements.

All tests are described in the *Testing and Maintenance* section of this manual.

Claims for Damage and Repackaging

Claims for Damage

When the equipment is received, if physical damage is evident or if the device does not meet the specified operational requirements of the patient safety checks or the extended self check, notify the carrier and the nearest Philips Sales/Support Office at once. Philips will arrange for immediate repair or replacement of the instrument without waiting for the claim settlement by the carrier.

Repackaging for Shipment or Storage

If the instrument is to be shipped to a Philips Sales/Support Office, securely attach a label showing the name and address of the owner, the instrument model and serial numbers, and the repair required (or symptoms of the fault). If available and reusable, the original Philips packaging should be used to provide adequate protection during transit. If the original Philips packaging is not available or reusable please contact the Philips Sales/Support Office who will provide information about adequate packaging materials and methods.

Installing the MX400/450/500/550 Monitor

NOTE

There are different mounting options available for the monitor. This section covers the general concepts of safe mount installations and specific steps for the mounting options sold by Philips. Instructions which ship with a mounting solution should always take precedence over the instructions described in this chapter.

You MUST follow the instructions that ship with the mounting solution, regardless of manufacturer.

Mounting Instructions

Assembling Mounts

- Every type of compatible mounting solution is delivered with a complete set of mounting hardware and instructions. Refer to the documentation delivered with the mounting hardware for instructions on assembling mounts. Compatible table mounts are:
  - M8000-64100 (table mount with gray tops and marked with date code 10/31 or higher), or
  - 453564239731 (completely made of stainless steel).

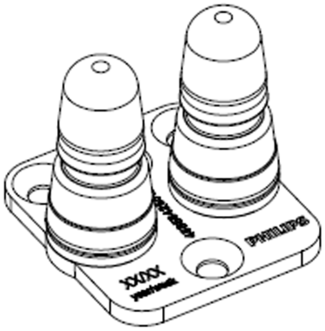
WARNING

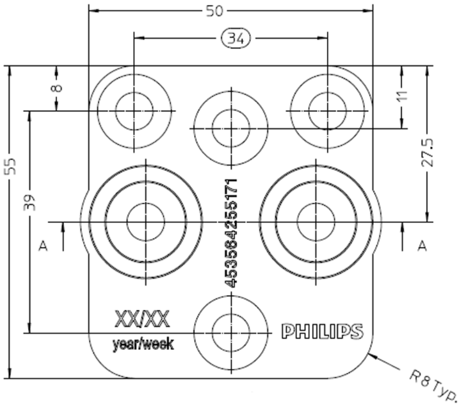
- It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.
- Ensure that this commitment has been met before assembling mounts.
- Incorrect mounting and use of inappropriate mounting material may lead to injury. It is the customer’s responsibility to ensure that the mounting procedures have been performed correctly and the appropriate mounting devices have been used.

Please mount the monitor using either the Philips Quick Mount or Fix Mount solution or another approved mounting solution. The mounting shall be done in a manner that no patient, operator or other person can be harmed by a monitor removed intentionally or released accidentally from the mount. When using the Quick Mount, be aware of the danger of accidental activation of the Quick Mount release button when lifting or moving items located under the monitor, such as pole mounts, etc. If in doubt, use the Philips Fix Mount solution to avoid such situations.

For instructions on how to mount the monitor using the Quick Mount table mount refer to the Assembly Instructions delivered with the mounting kit M8000-64100 or 453564239731.

An alternative mounting solution is the Fix Mount, which should be used for those installations where the Quick Mount might not be appropriate. The Fix Mount is already integrated into the monitor bottom housing.





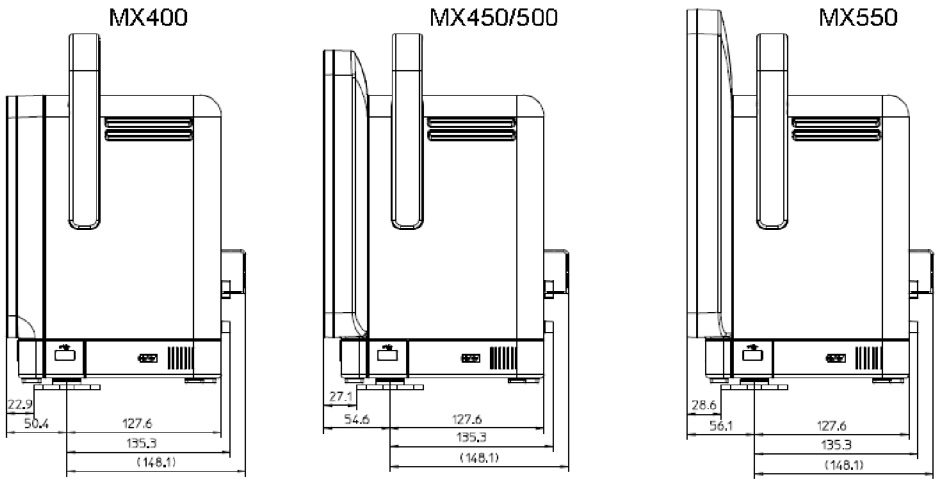
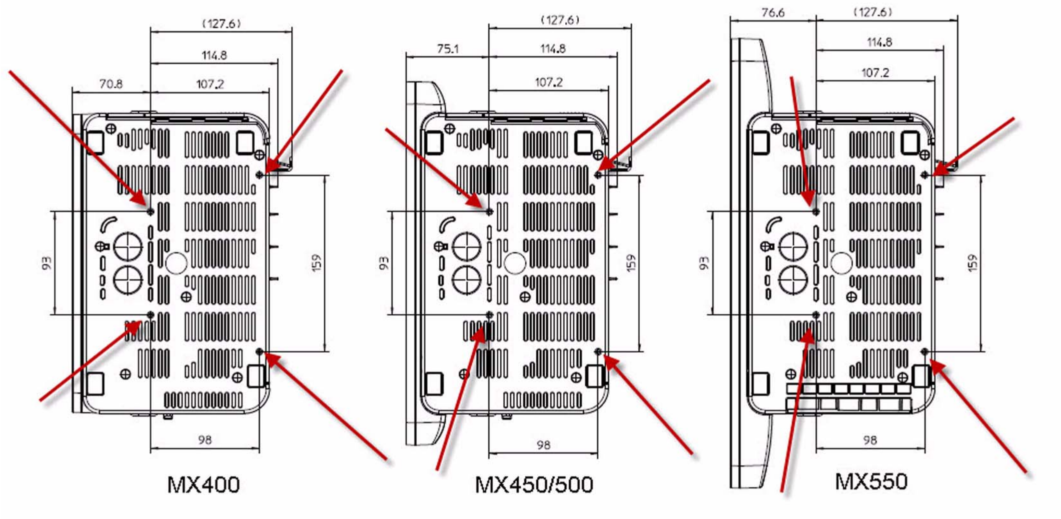

MX400
MX450/500
MX550
22.9
50.4
127.6
135.3
(148.1)
27.1
54.6
127.6
135.3
(148.1)
28.6
56.1
127.6
135.3
(148.1)

Table Mount (453564239731)


(127.6)
114.8
70.8
107.2
93
159
98
MX400
75.1
(127.6)
114.8
107.2
93
159
98
MX450/500
76.6
(127.6)
114.8
107.2
93
159
98
MX550

Position of Fix Mount

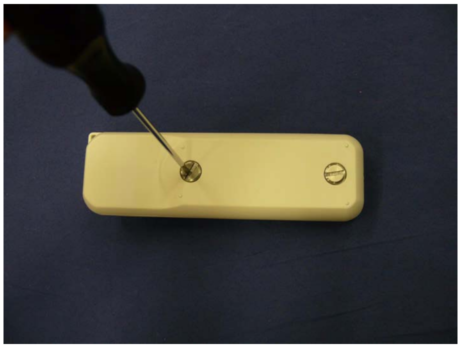
The Quick Mount is optional, the Fix Mount solution is shipped as standard.

Installing the Wired Remote Control

The remote control comes with a cradle and USB cable.

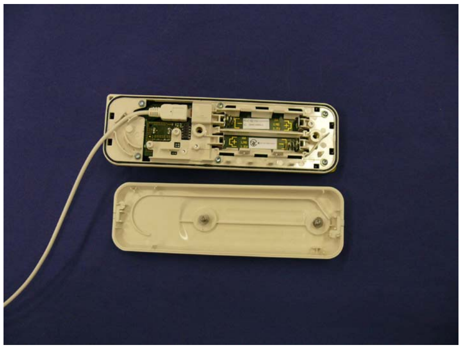
To install the remote control:

1 Remove the two screws on the back of the remote control.

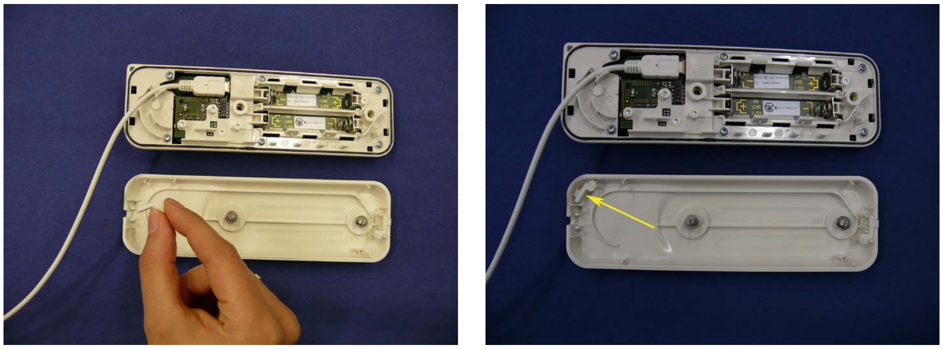


2 There are two ways to install the USB cable - at the top of the remote control or at the bottom. If you want to install the cable at the bottom of the remote control, proceed to step 3. To install the cable at the top of the remote control:

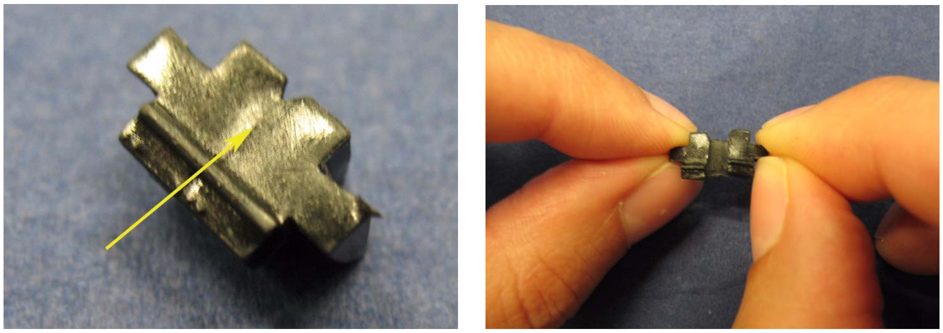
a. Plug the USB cable and lead it through the remote control housing as shown below.



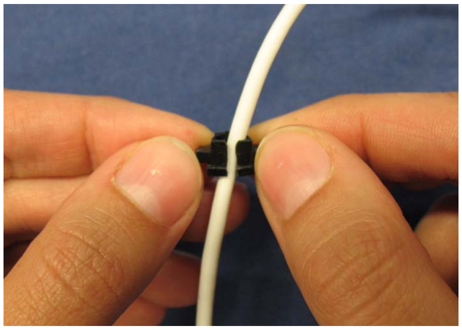
b. Remove the plastic cover from the top of the remote control rear housing and reinsert it in the corner of the housing as shown below.



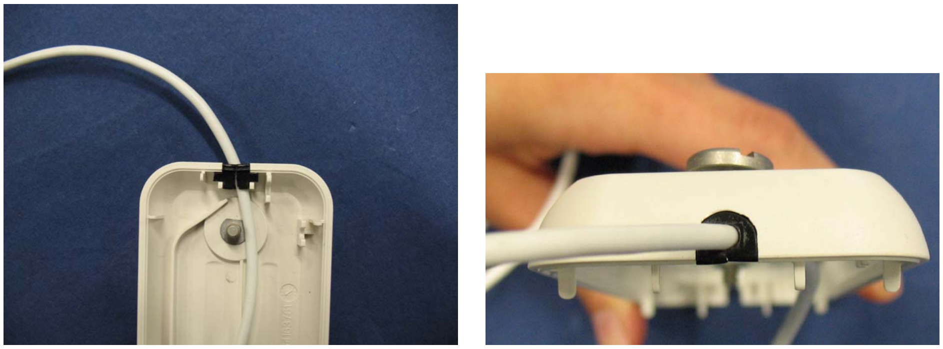
c. Break open the rubber seal for the USB cable at the perforation as shown below.



d. Insert the USB cable into the rubber seal.



e. Insert the rubber seal into the cable slot of the remote control housing.



NOTE

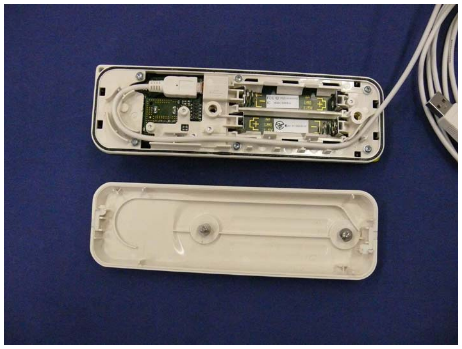
Be sure to always insert the rubber seal when installing the remote control, as it prevents liquid from running into the remote control.

a. Put the housing of the remote control back together and reinsert the screws.

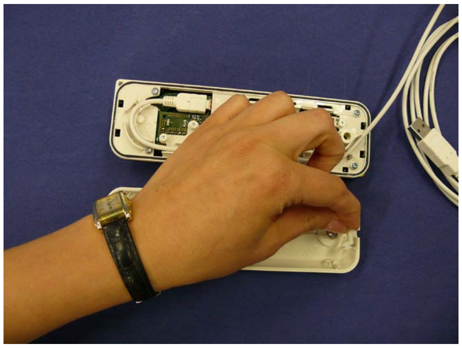
b. Perform a functional test to make sure the remote control is functioning correctly.

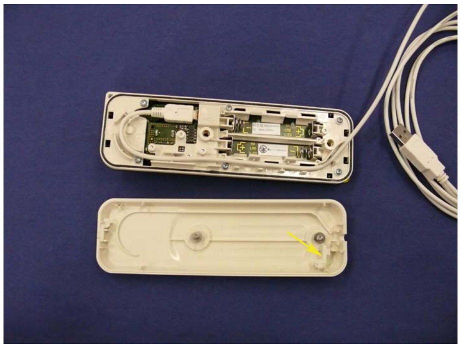
3 To install the cable at the bottom of the remote control:

a. Plug the USB cable and lead it through the remote control housing as shown below.

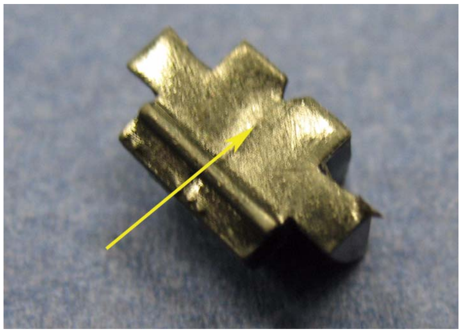


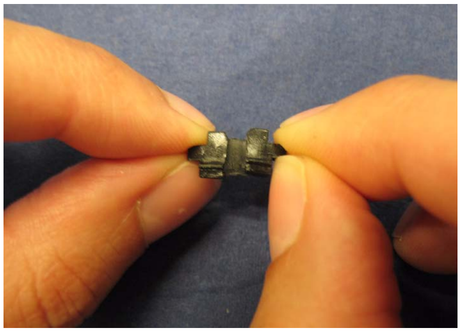
b. Remove the plastic cover from the bottom of the remote control rear housing and reinsert it in the corner of the housing as shown below.



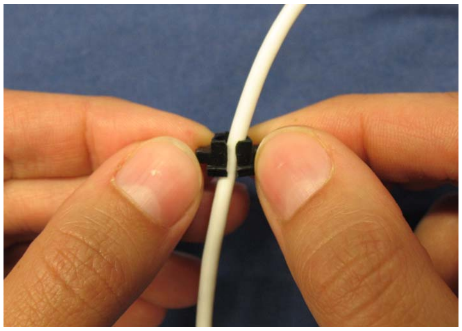


c. Break open the rubber seal for the USB cable at the perforation as shown below.

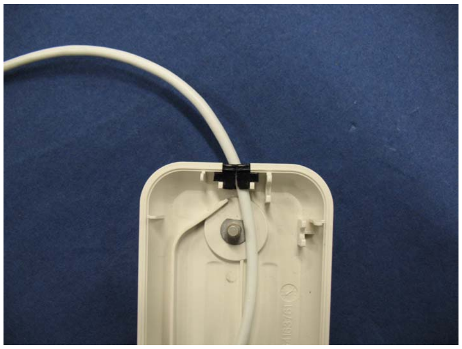


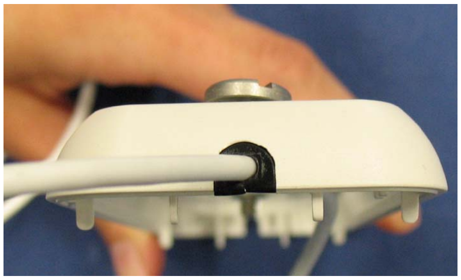


d. Insert the USB cable into the rubber seal.



e. Insert the rubber seal into the cable slot of the remote control housing.





NOTE

Be sure to always insert the rubber seal when installing the remote control, as it prevents liquid from running into the remote control.

a. Put the housing of the remote control back together and reinsert the screws.

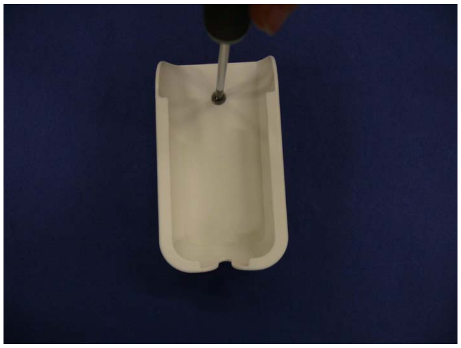
b. Perform a functional test to make sure the remote control is functioning correctly.

Mounting the Wired Remote Control

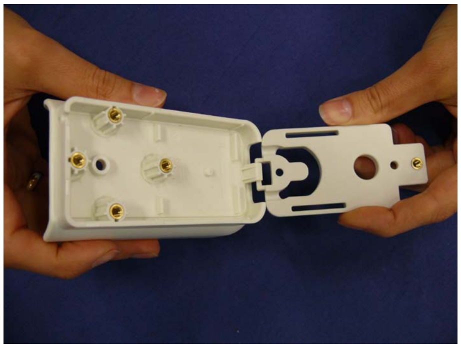
The Remote Control can either be mounted to a wall or with the Universal Mounting Clamp.

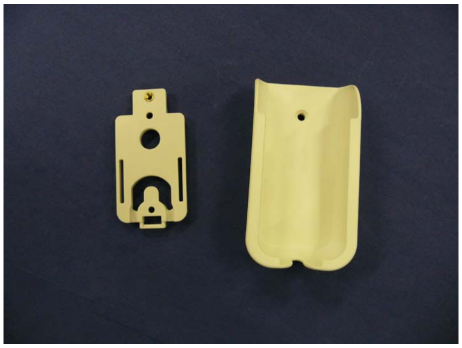
To mount the remote control to a wall:

1 Remove the screw from the remote control holder.

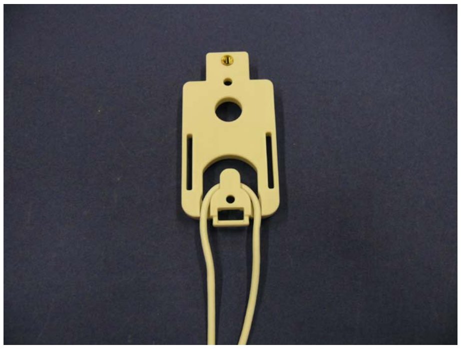


2 Separate the back plate from the remote control holder.





3 Insert the USB cable into the holder on the back plate at the desired length.

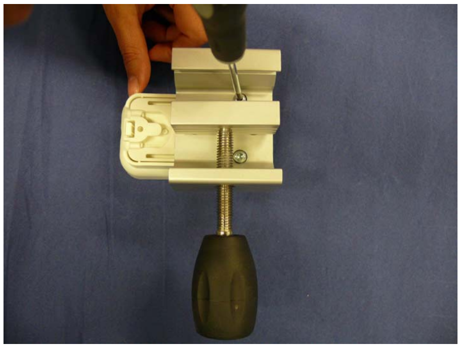


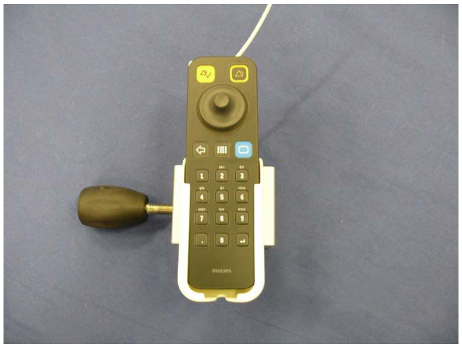
4 Screw the holder back plate to a wall and then reattach the holder to the back plate.

To mount the remote control using the Universal Mounting Clamp:

1 Make sure the back plate is attached to the cradle

2 Screw the Universal Mounting Clamp to the back of the cradle in the desired direction.





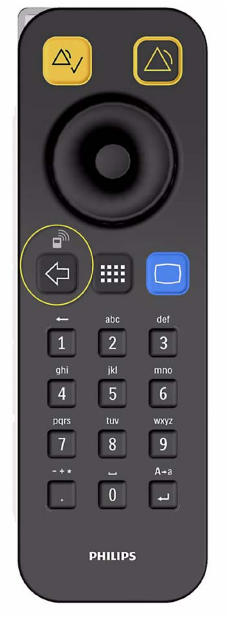
3 Insert the USB cable into the holder on the back plate at the desired length.

Installing the Wireless Remote Control

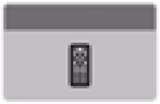
In order to use the wireless remote control with the monitor, the remote control must be assigned to the monitor first. To assign a remote control to the monitor:

1 Go into Service Mode or Configuration Mode.

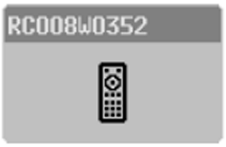
2 Press the back key for more than two seconds. This initiates the remote control discovery procedure.



The **Add Cableless** key appears instead of the measurement selection key.



3 Select the **Add Cableless** key to open the **Add Cableless** window. The Remote Control is shown in the window with a symbol and its label.



4 Select the remote control in the window. The monitor displays the assignment prompt message: **cl RC added** <clRC serial number>in the Status Line of the monitor.

NOTE

- While the remote control discovery procedure is active, the functionality of the remote control is disabled.
- If there is already a remote control assigned to the monitor, this remote control must be unassigned before a new remote control is assigned.

To remove a remote control:

1 Select **Main Setup-> Hardware -> cl Remote Control**

2 Select **Remove RemCtrl**

3 Select **Confirm** to unassign the remote control

CAUTION

When using a remote control without a cable, it is important that the user knows which remote control is assigned to which monitor. Use the tethering cable delivered with the remote control to attach it to a bed rail or IV pole, or label the remote control with the bed or monitor ID.

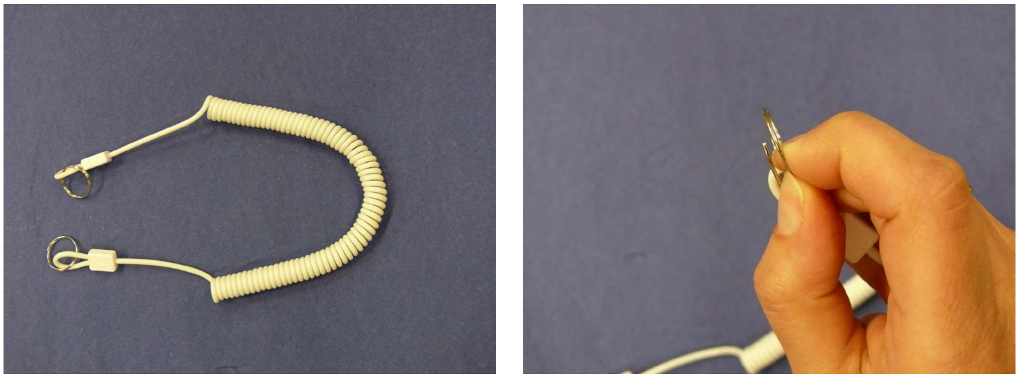
Wireless Remote Control Assignment Rules

- Only one remote control can be assigned to a monitor at a time. If you want to assign another remote control, you must unassign the remote control which is already assigned first.
- If you switch from wireless remote control to USB connected remote control operation with the same remote control, the assignment to the monitor will be lost. If you switch back to wireless remote control operation you will have to reassign the remote control.
- If you assign a wireless remote control to a second monitor without unassigning it from the first monitor and then come back to the monitor it was originally assigned to, press the back key on the remote control to start discovery mode. Once the remote control has been recognized by the monitor you can reassign it immediately. It does not have to be removed first.
- An assignment can only be initiated from the remote control itself.
- An unassignment can only be initiated from the monitor.
- If you exchange the battery of a remote control the assignment to a monitor is kept. You do not need to reassign the remote control

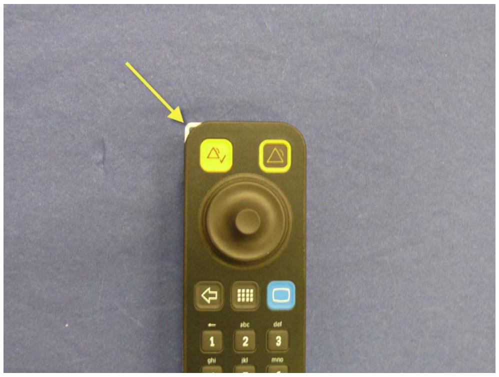
Installing the Tethering Cable

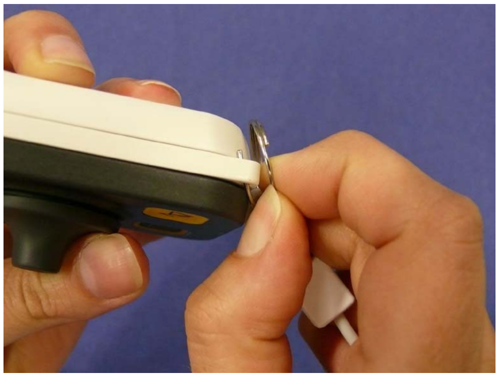
To attach the tethering cable to a remote control:

1 Pull apart the ring on one end of the tethering cable.



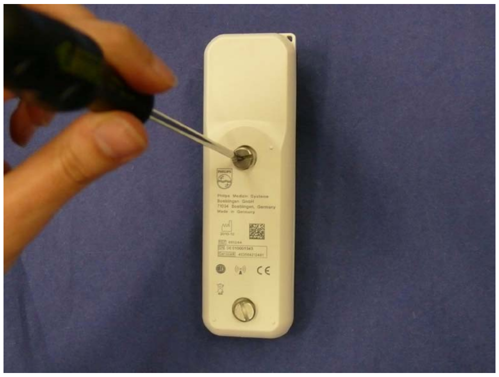
2 Insert the end of the metal ring spiral into the hole at the top left corner of the remote control.



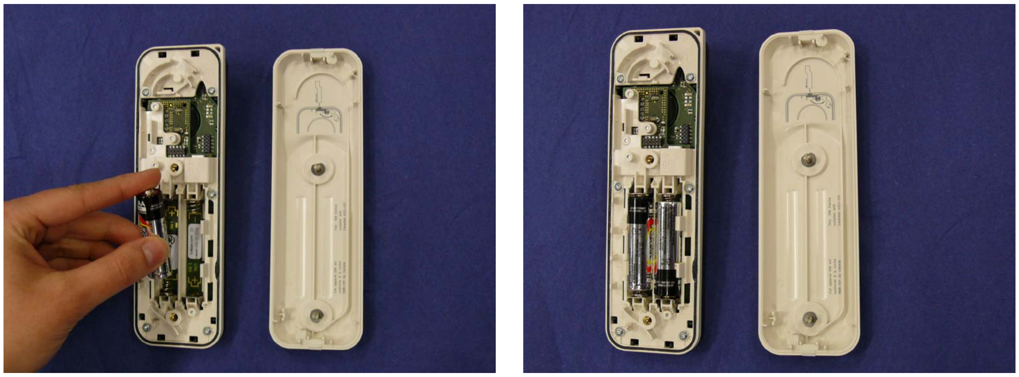


Exchanging the Remote Control Battery

1 Loosen the two screws on the back of the remote control and open the remote control.



2 Remove the old batteries and insert the new batteries as shown below.



3 Close the remote control and tighten the screws on the back cover.

4 Perform a functional test to make sure the remote control is functioning correctly.

NOTE

Use only non-rechargeable batteries with the remote control. Never attempt to charge non-rechargeable batteries.

To avoid leaking batteries, replace empty batteries immediately and do not use batteries after their expiration date. When a battery needs replacement, always change both batteries.

When the remote control is not used for a longer period of time, remove the batteries.

Connecting the Monitor to AC Mains

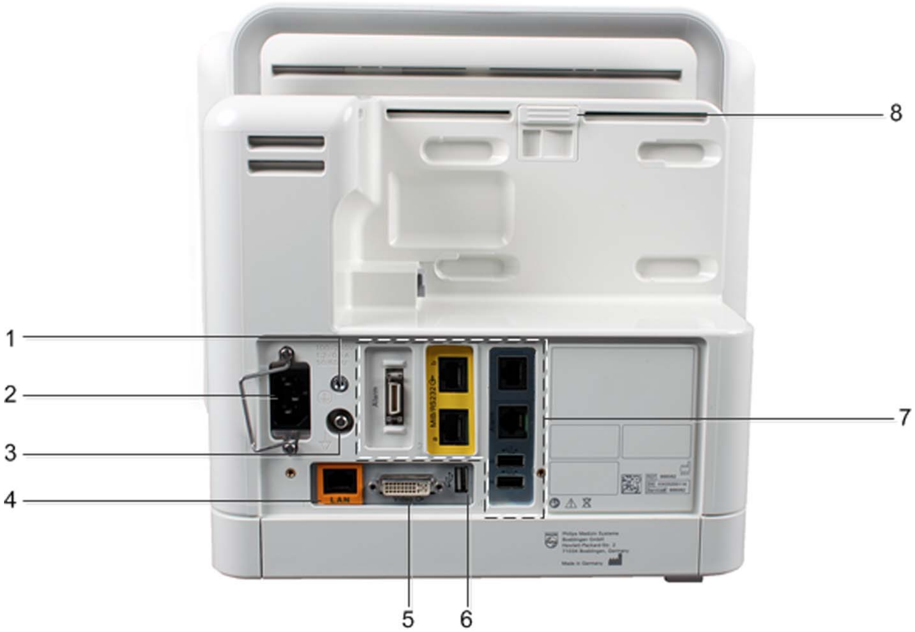
The monitor has a wide-range power supply that allows you to operate the monitor from an AC (alternating current) power source of 100 V to 240 V (± 10%) and 50/60 Hz (± 5%).

WARNING

- Always use the supplied power cord with the earthed mains plug to connect the monitor to an earthed AC mains socket. Never adapt the mains plug from the power supply to fit an unearthed AC mains socket.
- Do not use AC mains extension cords or multiple portable socket-outlets. If a multiple portable socket-outlet without an approved isolation transformer is used, the interruption of its protective earthing may result in enclosure leakage currents equal to the sum of the individual earth leakage currents, so exceeding allowable limits.
- Do not connect any devices that are not supported as part of a system.
- Any non-medical device placed and operated in the patient's vicinity must be powered via an approved isolation transformer that ensures mechanical fixing of the power cords and covering of any unused power outlets.
- The On/Standby switch does not disconnect the monitor from the AC power source. To disconnect, unplug the power cable.
- Always ensure that the monitor is positioned so that the AC power plug is easily accessible, to allow disconnection of the monitor from the AC power source.

Connections

The following figure shows the cable and interface board connections:



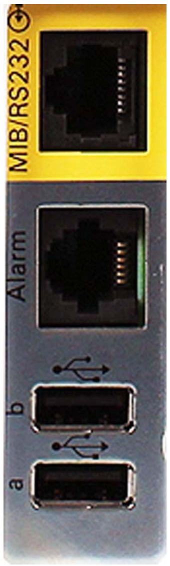
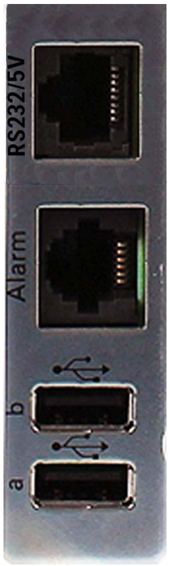
1	Protective earth screw hole
2	AC power input with clamp
3	Equipotential ground connector
4	Wired network connector (color-coded in orange)
5	Video out connector (digital/analog)
6	USB rear connector (for remote control, keyboard, pointing devices, printer)
7	Optional interfaces
8	Release switch for connected measurement modules

Optional Interfaces

Optional Interface	Description
	Flexible nurse call interface card

<table>
<tr><th colspan="2">Optional Interface</th><th>Description</th></tr>
<tr><td colspan="2">
MIB/RS232
b
a

</td><td>Dual medical information bus (MIB) RS232 Interface card (color-coded yellow)</td></tr>
<tr><td colspan="2">
IntelliBridge
EC10

</td><td>IntelliBridge EC10 interface board (color-coded dark gray)</td></tr>
<tr><td>Old Labeling

</td><td>New Labeling

</td><td>Advanced system interface:
Single RS232/5V Interface card
Nurse call
Additional USB slots</td></tr>
</table>

Connection of Devices via the RS232/5V Interface or MIB/RS232 I/O Board

The configuration of a specific RS232 port can be viewed in config mode and altered in service mode. This is required, for example, when a slave display with touchscreen is installed. To alter the configuration of an RS232 port select **Main Setup** then **Hardware** then **Interfaces.** You can configure **GM** or **Data Out** to the RS232 port.

Data Out can be configured up to two times (on two or more RS232 interfaces). Note that only one RS232 port configured to **Data Out** (i.e. the first one to receive a request) provides wave export. The other MIB/RS232 port configured to **Data Out** will only export numerics. If the RS232/5V interface is used for Data Out, a cross-over cable is required.

GM can only be configured **once** to an RS232 port.

NOTE

Be aware that if you change a port assignment this assignment is not reset upon boot up. If the MIB/RS232 board is removed and replaced with a different type of board the settings are deleted. If the MIB/RS232 board is then refitted, you must reconfigure the MIB/RS232 port. The configuration of MIB/RS232 is not cloned between monitors.

Connection of USB Devices

The USB ports support the following USB devices:

- printer (restrictions apply. See “Compatible Printers” on page 262 for details.)
- keyboard
- barcode scanner
- computer mouse or trackball
- remote control

NOTE

- Connect only the above mentioned devices to the USB Interface. Other devices are not supported.
- A remote control is treated as a keyboard.

CAUTION

The USB ports do not provide an electrical separation. When connecting a USB device which uses an additional power supply e.g. printer, a separation device according to EN/IEC 60601-1-1 is required. After installation a system test is required to ensure that the resulting equipment leakage current does not exceed the limits of EN/IEC 60601-1-1. For detailed information see the Testing and Maintenance chapter.

Compatible Printers

Printers connected to the USB port of the monitor need to have native PCL5 capability or higher.

The following printers have native PCL5 capability or higher and work when plugged into the USB port on IntelliVue Patient Monitors:

- HP LaserJet Pro 400 M401
- HP LaserJet Pro 400 M451dn (color)
- HP LaserJet Enterprise P3015DN
- HP LaserJet P2050 Series models (P2055d, P2055dn and P2055x)

If your selected printer has a comparable specification to the printers listed above, it is very likely that the printer will work with the IntelliVue Patient Monitor when connected to the USB port of the monitor.

NOTE

- Some printers ship with the "HP Smart Install" feature enabled. In these cases, the printer will not be identified by the monitor and the "HP Smart Install" feature needs to be disabled. For further details on how to disable the "HP Smart Install" feature, please refer to the documentation which ships with the printer. After disabling the "HP Smart Install" feature, the printer needs to be power cycled in order to make the printer work with the monitor.
- In rare cases, a specific native PCL5 or higher printer may not be supported. This is typically caused by different printer firmware implementations of the printer manufacturers. We recommend testing the functionality of any printer before installation.
- Printing a report on both sides of a page is not supported.

Configuring the USB Interface for Use with a Programmable Barcode Scanner

NOTE

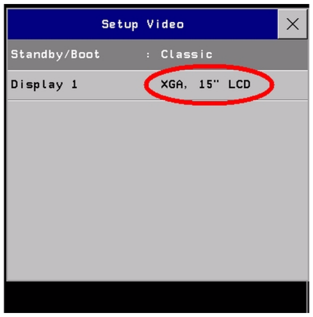
A programmable barcode scanner must be pre-configured to provide the codes in the correct form to the monitor. Refer to the Installation Note "Installing and Testing the 4600g Barcode Scanner" on the IntelliVue Documentation DVD for details.

Installing Remote Devices

This section provides instructions for Philips products. Installation instructions for devices not sold by Philips must be provided by the device manufacturer.

Hardware Settings

- This section lists settings grouped in the Hardware Settings Block which are available in Service Mode. These settings are set once per monitor and are the same in every profile. Any changes you make to the hardware settings configuration are automatically stored, there is no need to save them in an extra step. Hardware settings must be entered for each monitor individually, they are stored in the monitor, and they are not cloned. To enter the hardware settings menu, select **Main Setup** -> **Hardware**.
- Keyboard - this setting allows you to select the language of the keyboard connected via USB. See USB Keyboard/Mouse *section* in this chapter for details.
- Setup Video - this setting allows you to set the correct display resolution for the external displays and to choose between the basic (black background) or classic (photo of nurse and child in the background) standby/boot screen.



Standby/Boot : Classic

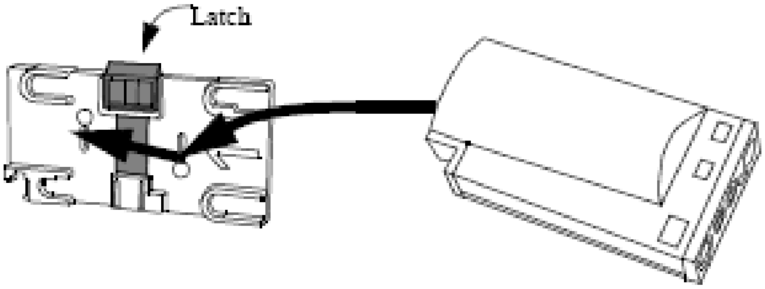
Display 1 XGA, 15" LCD

- MIB/RS232 - see section in this chapter for details.

Multi-Measurement Module

Attaching the MMS to a Mount

1. Make sure the Measurement Server is oriented correctly relative to the mount (see the picture below).
2. Place the Measurement Server on the back mount. If it is not tight against the mount, slip it in the direction of the measurement connectors until it is.
3. Slip the Measurement Server forward until it clicks into place.



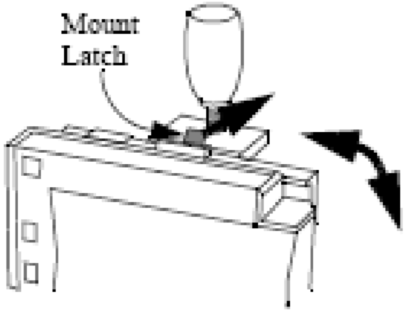
Detaching the Measurement Server from a Mount

1. Press and hold the latch (in the middle at the top of the mount) away from the Measurement Server.
2. Slide the Measurement Server off the mount in the direction of the measurement connectors.

Positioning the Measurement Server on a Clamp Mount

If you have your Measurement Server on the clamp mount, you can have it in one of four positions. You can reposition it as follows:

1. Press and hold the mount latch toward the clamp screw.



   Rotate the Measurement Server and mount until you get it to the position you want.

2. Release the mount latch, and make sure it is clicked into one of the four slots on the back of the mount.

Connections

The cable specifications and part numbers for through wall solutions of the M3001A are described in the *Site Preparation* section of this manual.

MSL Cable Termination

The following installation procedure describes how to install the wall installation cable kit when the patient monitor and the measurement server are not located at the same site. The kit consists of two connector boxes and a cable (15m or 25m).

For this procedure you need the insertion tool (M3086-43801) and a small screwdriver.

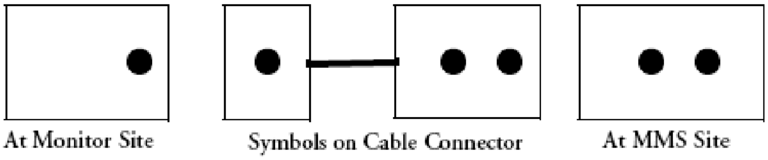
1 Draw the MSL cable through the wall from the site of the monitor to the site of the measurement server.

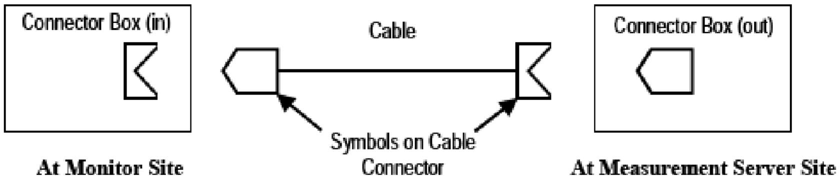
Each MSL face plate kit contains two connector boxes; one in-going and one out-going. (The US version contains an additional rectangular wall-mounting plate).

NOTE

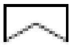
The installation procedure is the same for both connector boxes. This means you must perform steps 3 to 8 of this procedure twice.

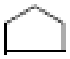
The connectors on each box are different, so you must ensure that the correct box is placed at the correct location. The dots on the plastic angled cover indicates at which site you should install the box:


At Monitor Site
Symbols on Cable Connector
At MMS Site


Connector Box (in)
Cable
Connector Box (out)
Symbols on Cable Connector
At Monitor Site
At Measurement Server Site

If there are no dots on the cover, symbols are used:

Symbol:  is connector box (in) and must be placed at the monitor site.

Symbol:  is connector box (out) and must be placed at the measurement server site.

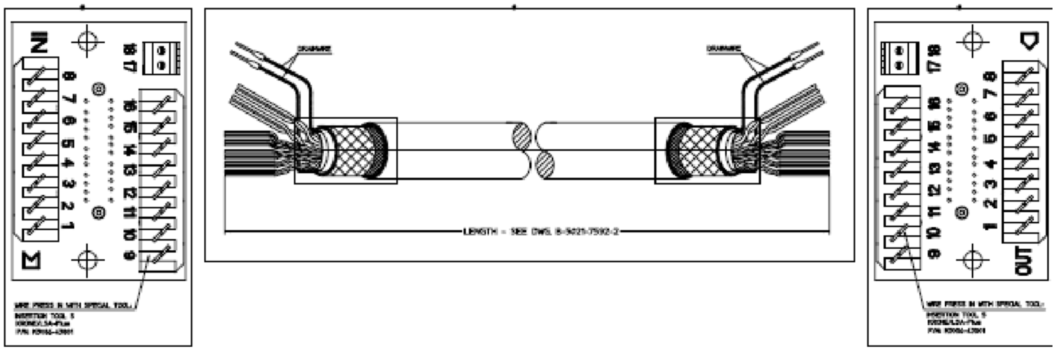
The correct connector cable (M3081-61601, M3081-61602 or M3081-61603) has the opposite symbol:

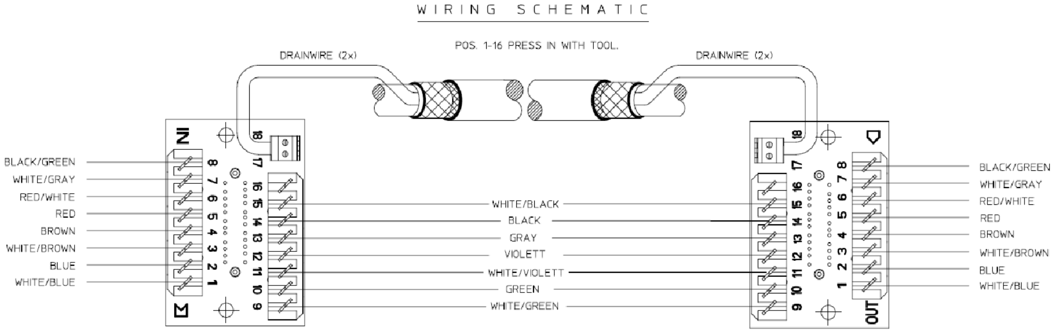
2 Detach the PCB assembly (in/out) from the metallic mounting flange.

3 Use the Insertion Tool (M3086-43801) to position each wire on the PCB according the wiring schematic below, where each color corresponds to a number.

NOTE

The Insertion Tool should be set to cutting mode on.


IN
OUT
DRAINWIRE
DRAINWIRE
WIRE PRESS IN WITH SPECIAL TOOL
INSERTION TOOL 5
LENGTH = SEE DWG


WIRING SCHEMATIC
POS. 1-16 PRESS IN WITH TOOL.
DRAINWIRE (2x)
DRAINWIRE (2x)
IN
OUT
BLACK/GREEN
WHITE/GRAY
RED/WHITE
RED
BROWN
WHITE/BROWN
BLUE
WHITE/BLUE
WHITE/BLACK
BLACK
GRAY
VIOLETT
WHITE/VIOLETT
GREEN
WHITE/GREEN
BLACK/GREEN
WHITE/GRAY
RED/WHITE
RED
BROWN
WHITE/BROWN
BLUE
WHITE/BLUE

Wiring Schematic

1. Use a small screwdriver to connect the two drain wires to the PCB, see the wiring schematic in .
2. Slide the PCB back on to the metallic mounting flange.
3. Use screws to fasten the mounting flange to the wall.

NOTE

US version only: Fasten the rectangular wall-mounting plate to the wall. Attach the mounting flange to the wall-mounting plate.

4. Mount the plastic cover. The plastic cover consists of two pieces:
   - Frame
   - Angled cover

   Put the frame over the mounting insert and the PCB. Place the angled cover on top and fasten with two screws.
5. Connect the monitor and the measurement server to the wall installation.
6. Perform the following tests as described in the Test and Maintenance section of this manual:
   - Power-on test blocks
   - Safety test blocks
   - ECG Sync Performance Test

Clinical Network (Wired and Wireless)

Creating a network solution to support patient monitoring system data is a significant undertaking. The network must be designed to support real-time transmission of patient waveforms, data, and alarms on an uninterrupted and continuous basis.

Philips can deploy a patient monitoring system in one of two ways:

1. Some customers prefer to purchase a patient monitoring system that includes a Philips-provided network switching infrastructure. These systems are known as a Philips-Supplied Clinical Network (PSCN).
2. Other customers prefer to run their patient monitoring system on the hospital's existing network infrastructure. These types of systems are known as a Customer-Supplied Clinical Network (CSCN).

Please refer to the appropriate PSCN/CSCN documentation when connecting bedside devices to an IntelliVue Information Center via PSCN or CSCN infrastructure.

For creating network solutions which connect to other systems than an IntelliVue Information Center please refer to the documentation of the respective systems.

WARNING

In order to maintain the galvanic isolation of the IntelliVue monitor, it is essential that UTP (Unshielded Twisted Pair) LAN cables is used to connect the IntelliVue monitor to other devices.

IntelliVue Instrument Telemetry (IIT)

Frequency Coordination (USA only):

Frequency coordination is a registration and coordination process for wireless medical telemetry devices used in the U.S.A. which operate in the FCC-allocated Wireless Medical Telemetry Service (WMTS) bands (608-614 MHz, 1395-1400 MHz, 1427-1432 MHz). The MX400-MX550 #J45 operates in both of the 1395-1400 and 1427-1432 MHz bands.

Under U.S. Federal Communications Commission (FCC) rules, authorized healthcare providers must register their WMTS devices with an authorized Frequency Coordinator designated by the FCC. The American Society for Healthcare Engineering (ASHE) is the current designated Frequency Coordinator.

Registration/Coordination is a two-step process.

Step 1: Registration: Register the healthcare facility on-line, from the ASHE website). Click on the link for Wireless Medical Telemetry Service and come to the registration page. Fill out the details, and pay the associated fee as per the instructions provided. You will receive confirmation of this registration. Confirmation must be received before proceeding to the next step.

Step 2: Frequency Coordination: Along with confirmation of registration, you will receive access information necessary to perform this second step, frequency coordination. This step involves logging the equipment and frequencies used into the FCC's database, so as to identify any existing potential interference and to help prevent potential future interference. Coordination is accomplished via the ASHE website. Click on the links for Wireless Medical Telemetry Service and then Frequency Coordination. The way the coordination process is executed as of today, it will need to be repeated twice; once for the 1395-1400 MHz band, and then again for the 1427-1432 MHz band, both of which are used concurrently by the Philips product. There is a separate fee for each coordination request, which varies, depending upon the number of transmitting devices used and the band/s of operation. Coordination is executed by a company named Comsearch, on behalf of ASHE.

To fill in the frequency coordination forms, you'll need to know the following:

- The county.
- Latitude and longitude that represents the center of the area where the transmitting devices will be deployed. Comsearch can help provide this information; *www.comsearch.com* provides contact information.
- The name/s of the Clinical Unit/s using the devices (e.g. ICU4, CCU-West, ER1, Step-Down North, etc.
- The radius of deployment, expressed in meters. Imagine drawing a circle around the center of the clinical unit, that encloses/encompasses the unit. What is its radius?
- The number of the highest floor on which a transmitting device will operate.
- How many transmitting devices will be used, i.e. the total number of IntelliVue Instrument Telemetry adapter devices combined.
- The Effective Radiating Power: 9 mW.
- The Equipment Manufacturer: Philips Medical Systems.
- The Model numbers: 866060/866062/866064/866066 #J45 IntelliVue Instrument Telemetry adapter used with 866060 (MX400), 866062 (MX450), 866064 (MX500) or 866066 (MX550)
- The Frequency Range to be used: Two separate coordinations are required: For the first one, click on the range of 1395.0 through 1400.0 MHz. For the second one, click on all the frequency ranges listed in the range of 1427.0 through 1432.0 MHz.

When both Registration and Frequency Coordination have been successfully completed, the IntelliVue Instrument Telemetry System can be activated. Note that this process is the responsibility of the customer, as the final "operator" of the transmitting equipment.

Philips IntelliVue Information Center

Please refer to the installation instructions and Instructions for Use of the IntelliVue Information Center Rev. System J or higher.

Wireless LAN

Installation of the WLAN interface should be performed by Philips service personnel.

For detailed WLAN specifications and WLAN infrastructure information (minimum RF signal level, minimum signal-to-noise ratio) please refer to the "Specifications" chapter in the Instructions for Use.

Short Range Radio

Installation of the Short Range Radio interface should be performed by Philips service personnel.

Before installing an SRR infrastructure it might be necessary to perform a site a survey to determine available channels. This should be performed by Philips telemetry installation experts.

Configuring SRR Channels

Hardware Setting: **Main Setup -> Hardware -> SRR Channel**

SRR channel settings only apply for monitors that have a short range radio interface installed. They must be set to match the hospital's wireless infrastructure. SRR channel settings are hardware settings and will typically be set by service personnel at installation.

Refer to your configuration guide for details.

SRR Channel Settings Configuration Implications

Channel Use this setting to configure the SRR channel the monitor should use. SRR provides a total of 16 channels in the ISM (2.4 GHz) band. The channels are labeled 11 to 26. Up to two SRR connections can be established per channel. The ISM band is not exclusively reserved for SRR applications. It is also used by, for example, Wireless LAN (WLAN) and the IntelliVue Telemetry network. For this reason, depending on the hospital's existing wireless infrastructure, a number of SRR channels might already be occupied by other wireless applications.

To achieve the best SRR performance possible, follow these recommendations:

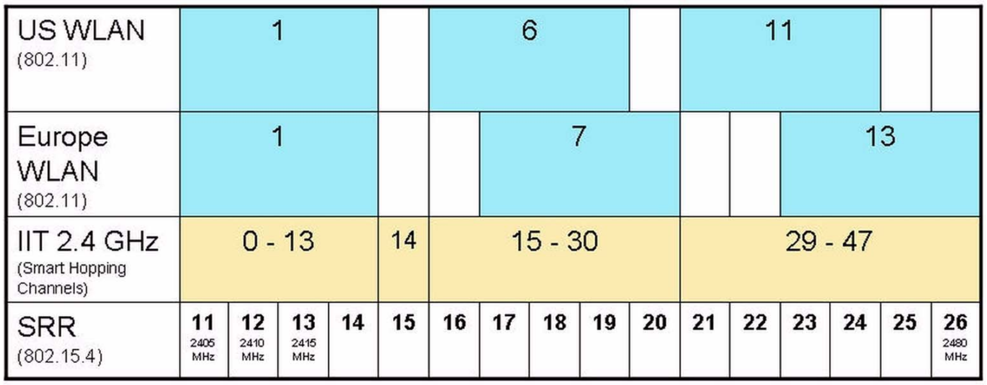
- Usage of WLAN together with SRR may cause interferences. Each WLAN network uses at least four of the 16 SRR channels. If the use of WLAN cannot be avoided, limit the number of channels used for the WLAN infrastructure to a minimum.
- Usage of Bluetooth devices together with SRR may cause interferences. Bluetooth devices automatically change channels regardless of whether a channel is already used by another component of the wireless infrastructure and therefore interfere with SRR connections.
- Usage of cordless phones using the ISM band in the vicinity of SRR devices may cause interferences.
- Usage of wireless PC keyboards or mice using the ISM band in the vicinity of SRR devices may cause interferences.

To assign SRR channels to all monitors in a unit that should be used with SRR connections,

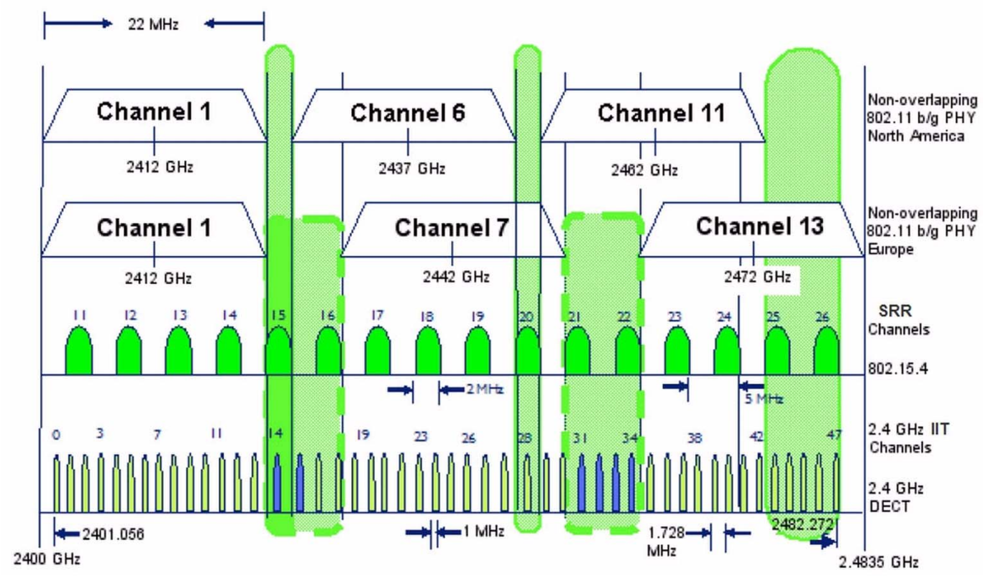
1. Identify unused SRR channels. This can be done by using commercially available tools, such as AirMagnet.
2. Obtain a floor plan of the unit and identify where the monitors with SRR interface are located.
3. Determine SRR groups. An SRR group may contain a maximum of two monitors which share the same SRR channel. Monitors belonging to an SRR group should be located close to each other.
4. For each SRR group, assign the same SRR channel to all monitors belonging to a group.

SRR Channel Restrictions with WLAN, IIT, and DECT Phones

The following table and graphic show the restrictions of WLAN, IIT, or DECT phone usage together with SRR.



US WLAN (802.11)	1					6					11					
Europe WLAN (802.11)	1						7						13			
IIT 2.4 GHz (Smart Hopping Channels)	0 - 13				14	15 - 30					29 - 47					
SRR (802.15.4)	11 2405 MHz	12 2410 MHz	13 2415 MHz	14	15	16	17	18	19	20	21	22	23	24	25	26 2480 MHz


22 MHz
Channel 1
2412 GHz
Channel 6
2437 GHz
Channel 11
2462 GHz
Non-overlapping 802.11 b/g PHY North America
Channel 1
2412 GHz
Channel 7
2442 GHz
Channel 13
2472 GHz
Non-overlapping 802.11 b/g PHY Europe
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
SRR Channels
802.15.4
2 MHz
5 MHz
0 3 7 11 14 19 23 26 28 31 34 38 42 47
2.4 GHz IIT Channels
2.4 GHz DECT
2401.056
1 MHz
1.728 MHz
2482.272
2400 GHz
2.4835 GHz

For a successful SRR deployment, the SRR channels must be located in RF spectra where they are least likely to be interfered with. Choosing appropriate channels after reviewing the Spectrum Analyzer date is critical. In hospitals, 802.11 systems are most the likely source of interference with SRR channels. The figures above show the relationship between 802.11 devices, IIT devices, and DECT phones. For example, if the site uses European 802.11 channel 1 for WLAN and has no IIT devices or DECT phones in the SRR channels 15 or 16, these channels can be used for SRR. Philips telemetry experts will identify available SRR channels by performing a site survey.

When using the Philips IntelliVue 802.11 Bedside Adapter we recommend that you use the 5 GHz band to free the 2.4 GHz band for SRR usage.

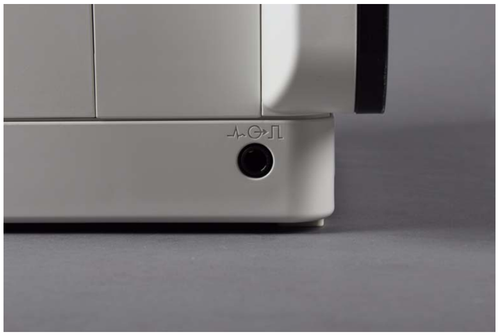
NOTE

Short range radio signals are low power signals and therefore have a relatively short range. You can use this fact if the number of unused channels is low, and you run out of channels. Provided the distance between two SRR groups is large enough, i.e. none of the short range radio signals transmitted by the one group can interfere with signals of the other group, you may attempt to assign the same SRR channel to both groups. Take into consideration that portable components (such as Telemetry transceiver, MP5/MP5T or an X2) belonging to one group may be temporarily used within the range of another group.

The range of SRR signals cannot be clearly defined as it depends on external factors such as the components and structure of walls, ceilings, etc.

ECG Out Functionality

Connections

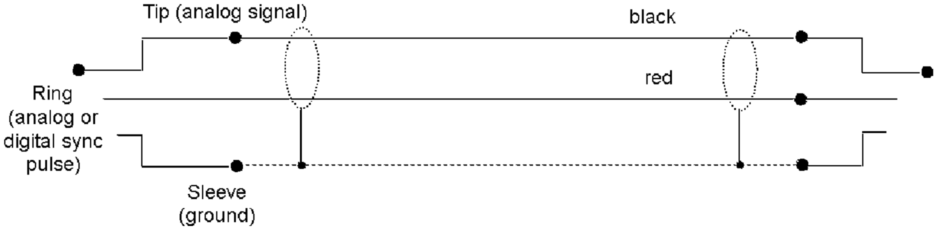


ECG Out Connector

The cables 8120-1022 and M1181-61625 have both ends terminated. The photograph above shows the monitor side connection.

If using a non-terminated cable:

1. Strip 5 mm (3/16") insulation from leads and twist conductor strands tightly.
2. Solder leads to the connector as shown in the following diagram.



WARNING

According to AAMI specifications the peak of the synchronized defibrillator discharge should be delivered within 60 ms of the peak of the R wave. The signal at the ECG output on the IntelliVue patient monitors is delayed by a maximum of 30 ms. Your biomedical engineer should verify that your ECG/Defibrillator combination does not exceed the recommended maximum delay of 60 ms.

Computer Client or Hospital Network connected to MX400/450/500/550 Internal LAN

The Computer Client and network infrastructure devices typically are not classified as medical devices and must be located outside the patient vicinity. The patient vicinity is defined as an area within 5ft (1.5m) of the perimeter of the patient's bed or within 8ft (2.5m) of the floor.

If the Computer Client is installed in the patient vicinity and connected to the monitoring device, it must be correctly isolated from the mains power supply by an isolation transformer.

If the Computer Client is installed in the patient vicinity and a network switch or hub is used to connect it to a monitoring device, it must be correctly isolated from the mains power supply by an isolation transformer.

WARNING

All external devices in the patient vicinity must comply with IEC 60601-1:1988 +A1:1991 +A2:1995 / EN 60601-1:1990+A1:1993 +A2:1995 (Ed.2) or IEC 60601-1:2005/EN 60601-1:2006+A1:2012 (Ed.3) including any national deviations. This applies also to all signal connections, entering the patient vicinity. Additional safety equipment, e.g. isolation transformers might be used.

The installation procedures e.g. for electrical connections as documented in the Instructions for Use must be strictly followed.

Configuration Tasks

You must configure these settings during installation in configuration mode.

- Line Frequency
- Printer
- Altitude
- Equipment Label (for wireless networked monitors, or when the Information center is in flexible monitoring mode).
- ECG cable colors
- Height and Weight units
- Setup Network
- Setup WLAN
- Setup IIT

Checking Country-Specific Default Settings

Some settings are made in the factory to match the typical requirements in a specific country. Line frequency, units for weight and height, and ECG cable colors (AAMI or IEC) have been set to appropriate values. If you suspect that these settings may not match your institution's requirements, check the settings and change them if necessary as described in the *Configuration Guide*.

WARNING

Before starting monitoring, check that the configuration meets your requirements, especially patient category, alarm limits and paced setting.

If you need to enter configuration mode:

1 In the **Main Setup** menu, select **Operating Modes**.

2 Select **Config** and enter the passcode.
The passcode for configuration mode is given in the monitor's Service Guide.

The monitor displays **Config** at the right hand side of the status line and in the center of the Screen while you are in configuration mode.

Before you leave configuration mode, always be sure to store any changes you made. You must store changes made to each Settings Block and to each Profile, individually. As it may be difficult to remember whether the settings you changed belong to a Monitor Settings block or a Measurement Settings block, we recommend that you store each block before you leave configuration mode.

To leave configuration mode:

♦ In the **Main Setup** menu, select **Operating Modes** and then select **Monitoring**.

Setting Altitude, Line Frequency, ECG Cable Colors and Height & Weight Units

You require a local barometric pressure rating from a reliable source (such as airport, regional weather station, or hospital weather station) that is located at the same altitude as the institution.

1. From the **Main Setup** menu, select **Global Setting**. Select **Altitude** and enter the altitude.
2. From the **Main Setup** menu, select **Global Setting**. Select **Line Frequency** and choose the Line Frequency.
3. From the **Main Setup** menu, select **Global Setting**. Select **ECG Cable Color** and choose the Cable Color.
4. From the **Main Setup** menu, select **Global Setting**. Select **Height Unit** and choose the Height unit.
5. From the **Main Setup** menu, select **Global Setting**. Select **Weight Unit** and choose the Weight unit.

Configuring the Equipment Label

If the Information Center is in fixed monitoring mode, it controls the equipment label. You do not need to follow this procedure.

However, if you are on a wireless network, or your Information Center is configured for flexible monitoring mode, you must set the equipment label. This associates the monitor with a central monitoring sector. An identical monitor label must also be configured in the Information Center.

1. Select **Main Setup** -> **Bed Information** to call up the **Bed Information** menu.
2. Select **Equipment Label** to call up the onscreen keyboard.
3. Enter the system identifier. This needs to be set up in either the monitor or the Information Center. If the Information Center is in flexible monitoring mode, the monitor must be setup to match the Information Center's monitor label.

Configuring the Printer

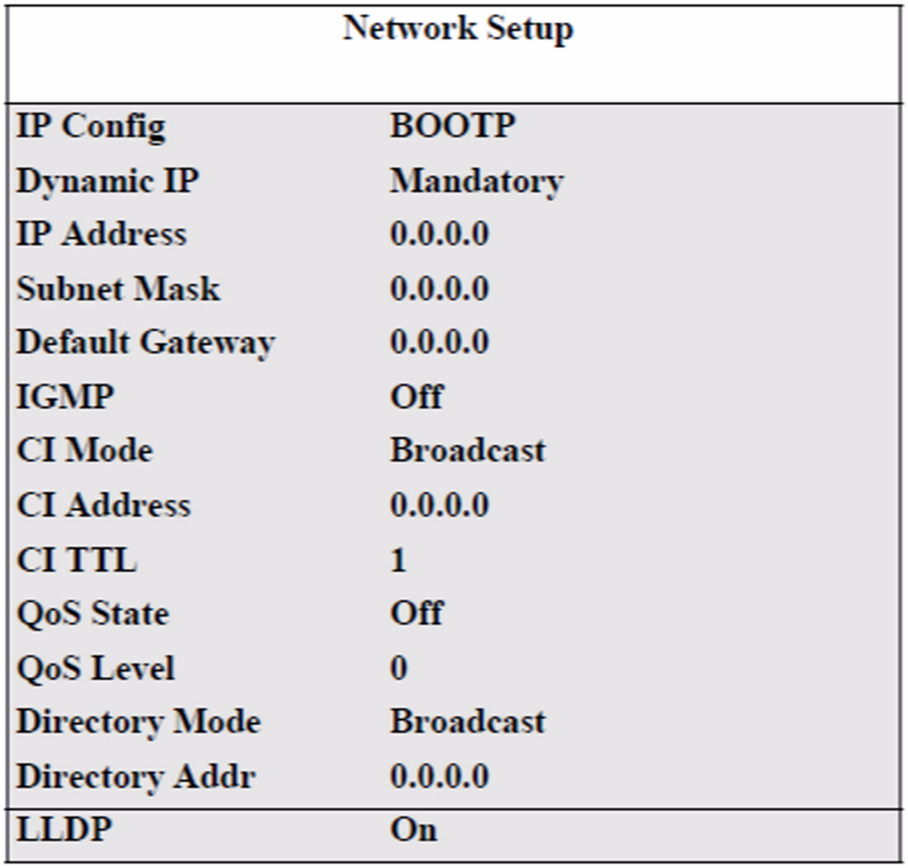
1. From the **Main Setup** menu select **Reports**.
2. Select **Printer Settings** and configure **Local** to enabled if the printer is connected directly to the monitor. See configuration guide for further details.

Setup Network

Network Setting Changes with K.2

Setting	Default Setting for <K.2	Default Setting for ≥K.2	Comment
Network			
IP Config	BOOTP	DHCP	In DHCP mode, BOOTP replies are also accepted
IGMP	Off	On	
CI Mode	Broadcast	Multicast	With the change to CI Mode= **Multicast**, the CI Address 224.0.23.63 will be used
CI TTL	1	8	
QoS State	Off	On	
QoS Level	0	6	
WLAN			
WMM Mode	Disabled	Enabled	

Main Setup => Network => Setup Network



Network Setup

IP Config	BOOTP
Dynamic IP	Mandatory
IP Address	0.0.0.0
Subnet Mask	0.0.0.0
Default Gateway	0.0.0.0
IGMP	Off
CI Mode	Broadcast
CI Address	0.0.0.0
CI TTL	1
QoS State	Off
QoS Level	0
Directory Mode	Broadcast
Directory Addr	0.0.0.0
LLDP	On

NOTE

LLDP added with Software Rev. J.1.

Directory Mode, Directory Addr added with Software Rev. H.0

CI Mode, CI Address, CI TTL and IGMP added with Software Rev. G.0

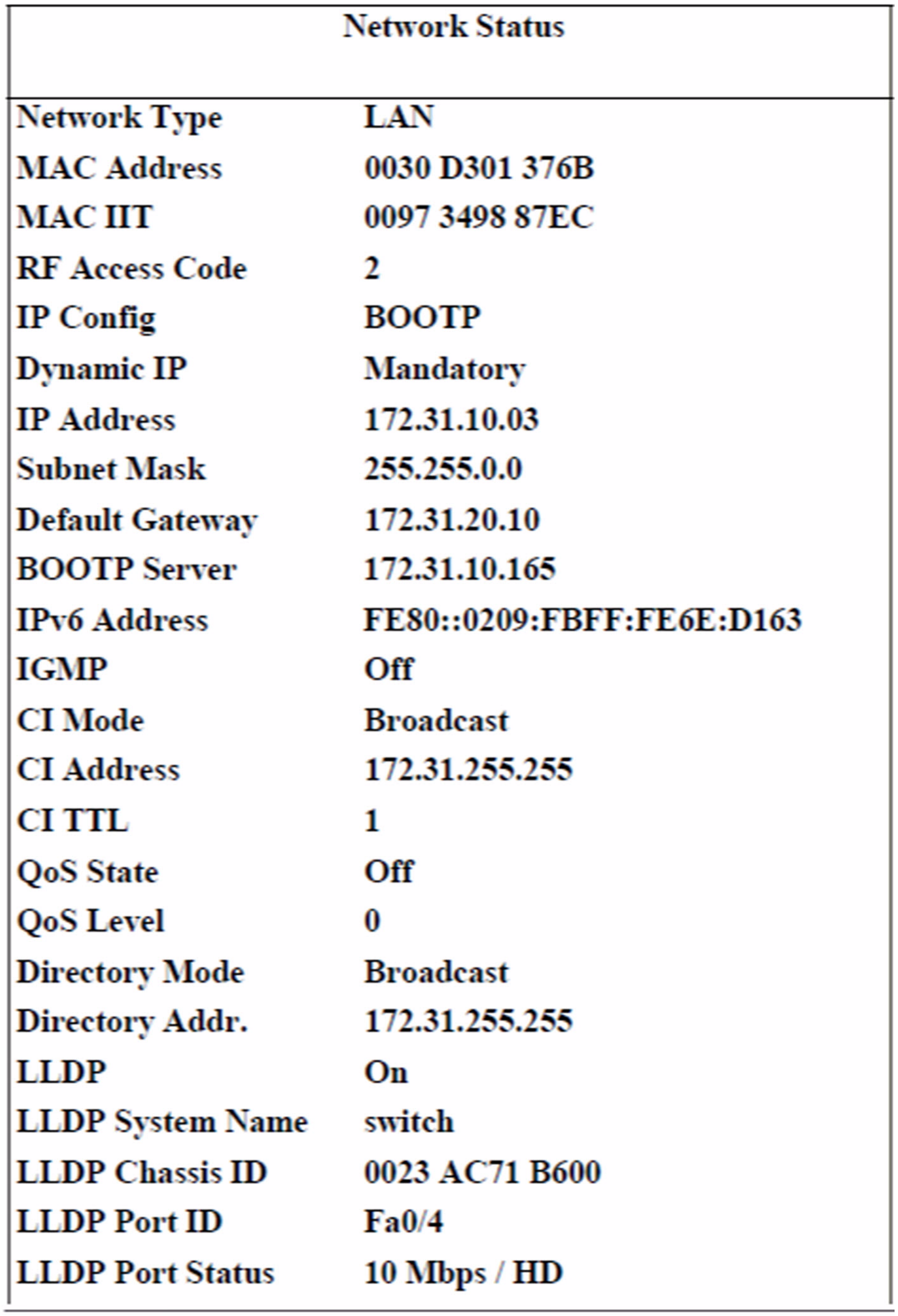
The Setup Network Menu allows you to configure the following items:

IP Config	Allows you to change the mode to acquire the IP address. Choices are **BOOTP, DHCP, DHCP restricted** and Manual. In **DHCP restricted** mode any true BOOTP responses are ignored.
Dynamic IP	Can be either **Mandatory** (default) or **Optional**. If Mandatory is set the bedside will announce an INOP if an IPv4 address could not be acquired.
IP Address	If IP Config is set to Manual, the IP Address should be a valid IP address, e.g. not 0.0.0.0. The configured value is ignored when IP Config is not set to Manual.
Subnet Mask	The Subnet Mask must be provided for manual IP addresses. The Subnet Mask must consist of a single consecutive series of “1” bits; e.g. 255.255.248.0. The configured value is ignored when IP Config is not set to **Manual**.
Default Gateway	The IP Address of the Default Gateway can be optionally configured. The configured value must be within the range of the Subnet Mask. The configured value is ignored when IP Config is not set to **Manual**.
IGMP	Enables or disables IGMP support (On/ Off).
CI Mode	The mode in which CI messages (Connect Indication messages) are sent (**Broadcast, Multicast, Manual**).
CI Address	Multicast Address for Device Connect Indication (only used if CI Mode is set to **Manual**). If **CI Mode** is set to **Broadcast,** the CI Address is implicitly the subnet broadcast address. If **CI Mode** is set to **Multicast** the CI Address is implicitly 224.0.23.63
CI TTL	Sets the TTL (Time To Live) of the CI message.
QoS State	QoS (Quality of Service) can be switched **On** or **Off**.
QoS Level	The QoS Level (DSCP CoS value) can be entered between 0 and 7.
Directory Mode	The mode in which Directory Service requests are received (Broadcast, Multicast)
Directory Addr	Multicast address for Directory Service requests (if Directory Mode set to Multicast).
LLDP	LLDP (Link Layer Discovery Protocol) enables information exchange with other devices. Can be switched **On** or **Off.**
Store	The entered values are verified when the “Store” softkey is pressed. A valid configuration is immediately activated and the window closed. If any field is invalid (e.g. invalid subnet mask or gateway not in subnet), an error popup window is shown and the configuration is not applied.

Network Status Window

The network status window provides network status information which can be used for troubleshooting purposes.

Main Setup => **Network** => **Network Status**



Network Status	
Network Type	LAN
MAC Address	0030 D301 376B
MAC IIT	0097 3498 87EC
RF Access Code	2
IP Config	BOOTP
Dynamic IP	Mandatory
IP Address	172.31.10.03
Subnet Mask	255.255.0.0
Default Gateway	172.31.20.10
BOOTP Server	172.31.10.165
IPv6 Address	FE80::0209:FBFF:FE6E:D163
IGMP	Off
CI Mode	Broadcast
CI Address	172.31.255.255
CI TTL	1
QoS State	Off
QoS Level	0
Directory Mode	Broadcast
Directory Addr.	172.31.255.255
LLDP	On
LLDP System Name	switch
LLDP Chassis ID	0023 AC71 B600
LLDP Port ID	Fa0/4
LLDP Port Status	10 Mbps / HD

Network Type	Displays the current active network type (**LAN, IIT, WLAN**)
MAC Address	MAC Address of LAN adapter
MAC IIT	MAC Address of IntelliVue Instrument Telemetry adapter (only when IIT is enabled)
RF Access Code	IntelliVue Instrument Telemetry specific partitioning of the radio domain (only when IIT is enabled)
LLDP System Name	Advertised System Name of the link partner. This is normally a switch or router.

LLDP Chassis ID	Advertised Chassis ID of the link partner. Chassis ID is an administratively assigned name that identifies the particular chassis.
LLDP Port ID	Advertised Port ID of the link partner. Port ID is a string that identifies the port component of the link partner.
LLDP Port Status	Shows the current ethernet duplex mode and the speed of the link partner.

The **MAC Address**, current IP address configuration (**IP Address, Subnet Mask, Default Gateway, Server IP address and CI mode/ CI Address/ CI TTL**) and **BOOTP/ DHCP Server** is displayed. The IP address configuration can be changed in Service Mode only. Manually entered IP addresses are marked by the suffix “Manual”, invalid fields are marked by the suffix “Invalid”.

If the Instrument Telemetry interface is available, its **MAC Address** and **RF Access Code** are displayed. In addition, the bedside monitor’s IPv6 link local address is shown.

Network Configuration Check (only for SW ≥ K.2)

If LLDP is configured "on" while a network connection is established, the network is checked for specific LLDP related issues or incompatibilities.

If issues are found during this check, the status message „Check LLDP Configuration" will be shown in the status prompt area of the monitor's resting display.

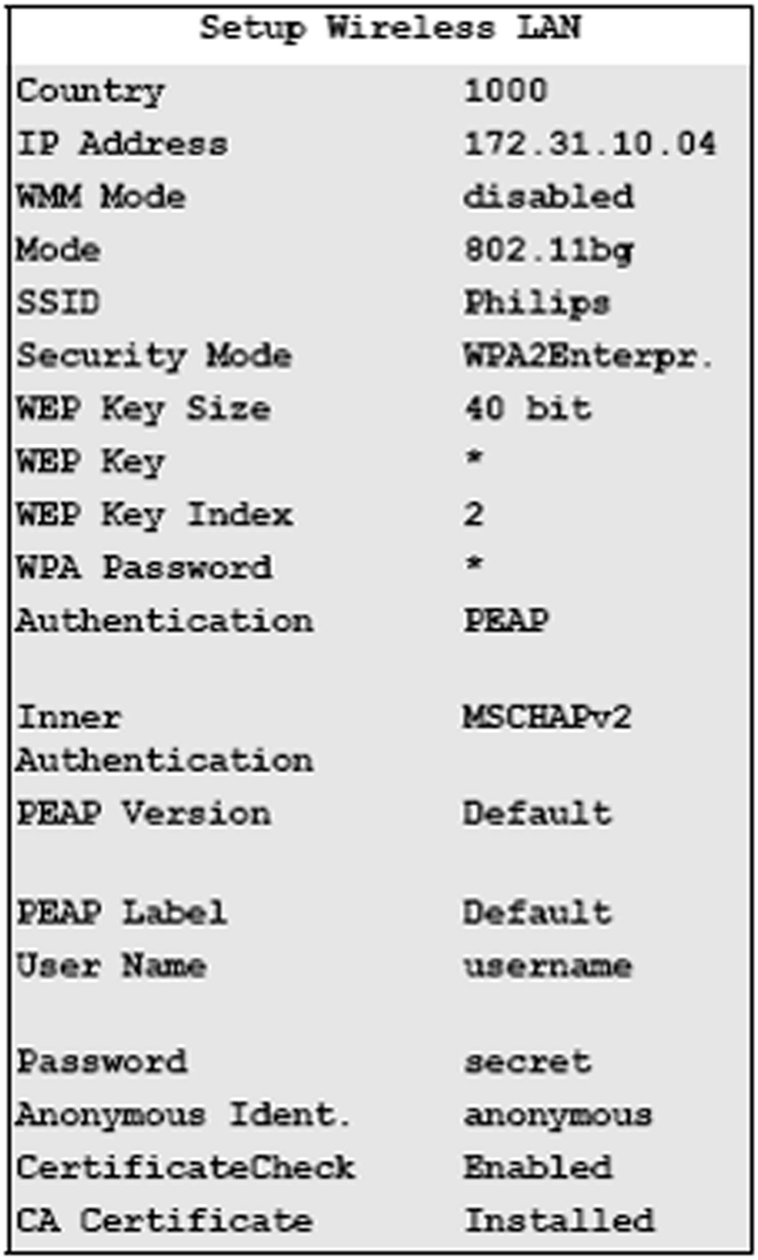
The status message is shown when one of the following issues is found:

Cause of Failure	Failure Isolation and Remedy
LLDP is configured "on" and a static IP is configured and LLDP answers are received via the network	do not configure a manual IP address when using LLDP
LLDP is configured "on" and the received Chassis ID and Port ID of the link partner changed	Check LLDP settings of switch
LLDP is configured "on" and more than one link partner is sending LLDP answers (e.g. if monitor is connected to hub or non- LLDP/ multicast capable switch)	connect monitor to LLDP/multicast capable devices

The prompt will be cleared after a power cycle or after reconnecting the network cable, but will be shown again if the issue persists.

Setup WLAN

Main Setup => Network => Setup WLAN



Setup Wireless LAN

Country	1000
IP Address	172.31.10.04
WMM Mode	disabled
Mode	802.11bg
SSID	Philips
Security Mode	WPA2Enterpr.
WEP Key Size	40 bit
WEP Key	*
WEP Key Index	2
WPA Password	*
Authentication	PEAP
Inner Authentication	MSCHAPv2
PEAP Version	Default
PEAP Label	Default
User Name	username
Password	secret
Anonymous Ident.	anonymous
CertificateCheck	Enabled
CA Certificate	Installed

The Setup Wireless LAN Menu allows you to configure the following items:

Country Country setting for the WLAN card to adapt to the local frequency and transmit power regulations. The default value 1000 should be left to support adapting to country provided by the AP.

IP Address IP Address of the WLAN card. Typically the automatic configuration via the BOOTP/ DHCP Server of the central station is used. In this case the field is set to 0.0.0.0. For special requirements, it is possible to switch to a manual/fix IP address configuration.

Manually entered IP addresses are marked by the suffix “Manual”

NOTE

- The subnet mask and the gateway address of the WLAN card will be taken from the corresponding fields in the **Bed Information** or **Setup Network** menu.
- Only limited checks of the manual values are possible. Therefore it is mandatory that a manual configuration is only performed by experienced service personnel to prevent problems such as duplicate IP addresses, non matching subnet mask, etc.

WMM Mode	Changes to WMM (Wireless Multimedia Mode) mode for the WLAN adapter supporting this feature.
Mode	Defines the WLAN operating mode/ IEEE 802.11 Standard. Valid values are either 802.11ah, 802.11bg, 802.11g, Auto or None. None indicates that no wireless connection should be estab-lished although a wireless adapter is available and operational.
SSID	Set Identifier: Logical WLAN Network Name.
Security Mode	**WEP**, **WPA(PSK)** or **WPA2(PSK)**, **WPA-Enterprise** and **WPA2-Enterprise** with either Protected EAP (PEAP) or Tunneled TLS (TTLS) as authentication methods.
WEP Key Size	40 bit or 104 bit.
WEP Key	The number of hex chars for the WEP key depends on the WEP key size chosen. For a 40 bit WEP key size the WEP key must be 10 hex chars long, for a 104 bit key the WEP key must be 26 hex chars long. Will be shown as “*” after the user entered the key.
WEP Key Index	Defines the transmit WEP Key Index. This entry must match the WEP Key Index configured at the infrastructure device, i.e. on a WLAN Access Point, and ranges from 1 to 4.

NOTE

For MX400/450/500/550, only WEP Key Index 1 can be used. WEP Key Indices 2-4 can be configured, but will be ignored.

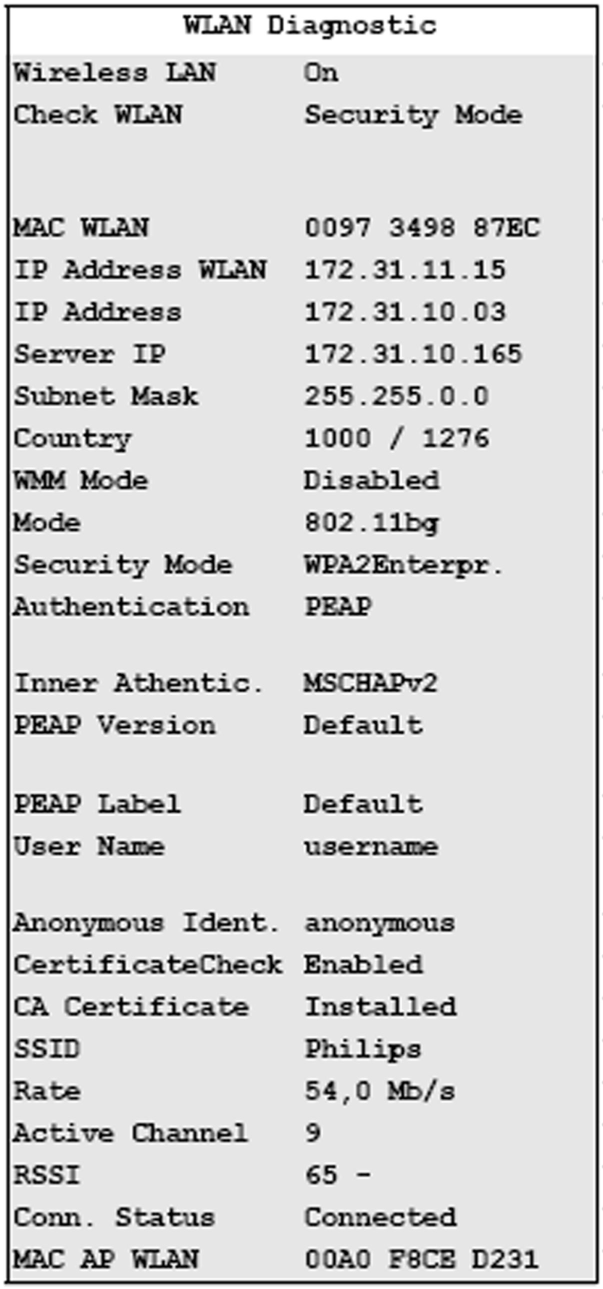
WPA Password	In WPA(PSK) or WPA2(PSK) mode this entry defines the Pre-Shared-Secret or Password with 8 to 63 alpha-numeric characters. Will be shown as “*” after the password is entered. In WPA-Enterprise or WPA2-Enterprise mode the following read only fields are available. The configuration can only be performed via the IntelliVue Support Tool:
Authentication	Authentication method can be either Protected EAP (PEAP) or Tunneled TLS (TTLS).
Inner Authentication	PEAP and TTLS can be used with several different Inner Authentication methods. PEAP with MSCHAPv2 and TTLS with PAP, CHAP, MSCHAP or MSCHAPv2
PEAP Version	This setting describes the PEAP protocol version to be used while authenticating against the authentication server. Valid values are either Default, Version 0 and Version 1. If set to Default the decision is up to the wireless adapter. Version 0 or 1 forces the wireless adapter to use the protocol version required for a certain authentication server. This setting is intended for experts only.
PEAP Label	The PEAP label setting defines the string to be use to signal EAP-PEAP encryption to the authentication server. Valid values are Default, EAP or PEAP. Default lets the decision up to wireless adapter. Both EAP and PEAP forces the wireless adapter to use this setting. This setting is intended for experts only.
Username	The username used in the encrypted tunnel with 1-63 alpha-numeric characters. It is also used as outer identity as long as the Anonymous Identity is not set.

Password	The password used in the encrypted tunnel with 8-63 alpha-numeric characters. Will be shown as four stars “****” after the user entered the password.
Anonymous Identity	The identity used for the outer PEAP or TTLS authentication, which may be “unprotected”. Thus, the identity should be different to the Username for enhanced security. The Anonymous Identity contains 1-63 characters. It can be set to NotConfigured by clearing it.
CA Certificate	Indicates that the certificate of the Certification Authority (CA) has been installed on the device. The CA certificate is the root certificate of the server delivered certificate chain. The certifcate chain ends with the server certificate, which contains the key material used to build up the encrypted tunnel for PEAP or TTLS. Values are either Installed or NotInstalled. This field is not user configurable. The CA certificate can only be installed with the Intellivue Support Tool.
Certificate Check	As long the Certificate Check is set to Enabled, the CA Certificate is used to verify the authenticity of the certificate chain delivered by the authentication server. The verification involves also the system time to check the validity period of every certificate in the chain. This item can only be set to Enabled, if an CA Certificate has been installed. Valid values are Disabled or Enabled.

WLAN Diagnostic Window

The WLAN Diagnostic window provides WLAN status information which can be used for troubleshooting purposes.

Main Setup => **Network** => **WLAN Diagnostic**



```
          WLAN Diagnostic
Wireless LAN       On
Check WLAN         Security Mode


MAC WLAN           0097 3498 87EC
IP Address WLAN    172.31.11.15
IP Address         172.31.10.03
Server IP          172.31.10.165
Subnet Mask        255.255.0.0
Country            1000 / 1276
WMM Mode           Disabled
Mode               802.11bg
Security Mode      WPA2Enterpr.
Authentication     PEAP

Inner Athentic.    MSCHAPv2
PEAP Version       Default

PEAP Label         Default
User Name          username

Anonymous Ident.   anonymous
CertificateCheck   Enabled
CA Certificate     Installed
SSID               Philips
Rate               54,0 Mb/s
Active Channel     9
RSSI               65 -
Conn. Status       Connected
MAC AP WLAN        00A0 F8CE D231
```

In the WLAN Diagnostic window, the wireless LAN address information is shown (**MAC address**, **IP addresses** and **Subnet Mask**) as well as the active security settings, WLAN **Mode**, **SSID** as well as **Country** setting, which are all not editable in this window. In addition, the following status information is shown:

Wireless LAN	State of the wireless adapter. Off indicates inactive or just starting, On indicates operational. Does not take the wireless state into account.

Check WLAN	Indicates that a configuration issue has been detected. The message text depends on the operating mode.
Country	The configured country code and the dynamically chosen country code based on access point setting.
WMM Mode	The WMM mode being used.
RSSI	Received Signal Strength Indicator.
Conn. Status	Current wireless LAN connection status (**None, Scanning, Authenticating, Authenticated Shared, Associating, Connected, Link Problem**).
Active Channel	Current radio channel.
Rate	Currently selected transmission rate (adapts dynamically based on wireless signal propagation behavior).
MAC AP WLAN	The MAC address of the access point to which a connection has been established.

WLAN Configuration Check

Before a wireless connection is established, the configuration is checked for basic issues or incompatibilities. If issues are found during this check, a status message will be shown in the status prompt area of the monitor's resting display. Additionally, the Check WLAN line of the WLAN Diagnostic window will display the status message. In Service Mode, a detailed status message is shown, while a simplified message is shown in all other operating modes.

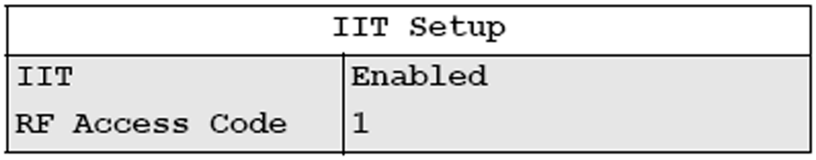
The table below lists the status messages displayed in service mode, depending on the issue found.

Issue	Status Message
Security Mode	Check WLAN Security Mode
Country Setting	Check WLAN Coutry Setting
IEEE Wireless Mode	Check WLAN IEEE Mode
WMM Mode	Check WLAN WMM Mode
WEP Encryption	Check WLAN WEP Settings
WPA Encryption	Check WLAN WPA/WPA2 Key
Authentication	Check WLAN Authentication Mode
Inner Authentication	Check WLAN Inner Authentication Mode
PEAP settings	Check WLAN PEAP Properties
Certificate Check	Check WLAN Certificate Check Setting
User Name,Password	Check WLAN EAP Credentials

The simplified message in all other operating modes is "Check WLAN Settings"

Setup IIT

Main Setup => **Network** => **Setup IIT**



IIT Setup	
IIT	Enabled
RF Access Code	1

The Setup IIT Menu allows you to configure the following items:

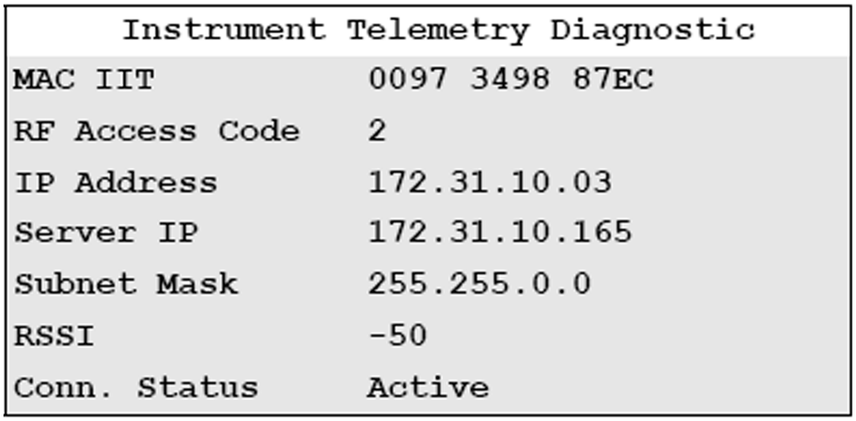
Instr. Telemetry The Instrument Telemetry network interface can be disabled by a Global Setting to suppress network related technical INOPS if the IIT-capable device is operated in a non-IIT environment.

RF Access Code Instrument telemetry specific partitioning of the radio domain. Displays "Disabled" instead of RF Access Code if Instrument Telemetry is disabled by Global Setting.

Instrument Telemetry Diagnostic Window

The Instrument Telemetry Diagnostic window provides IIT status information which can be used for troubleshooting purposes.

Main Setup => **Network** => **IIT Diagnostic**



Instrument Telemetry Diagnostic	
MAC IIT	0097 3498 87EC
RF Access Code	2
IP Address	172.31.10.03
Server IP	172.31.10.165
Subnet Mask	255.255.0.0
RSSI	-50
Conn. Status	Active

Network addresses To support troubleshooting of the network connection, the following fields are displayed: Instrument Telemetry **MAC Address, IP Address, BOOTP/ DHCP Server IP address** and **Subnet Mask.**

RF Access Code Instrument telemetry specific partitioning of the radio domain. Displays "Disabled" instead of RF Access Code if Instrument Telemetry is disabled by Global Setting.

RSSI Received Signal Strength Indicator.

Conn. Status Current connection status of the Instrument Telemetry Subsystem.

IntelliBridge EC10

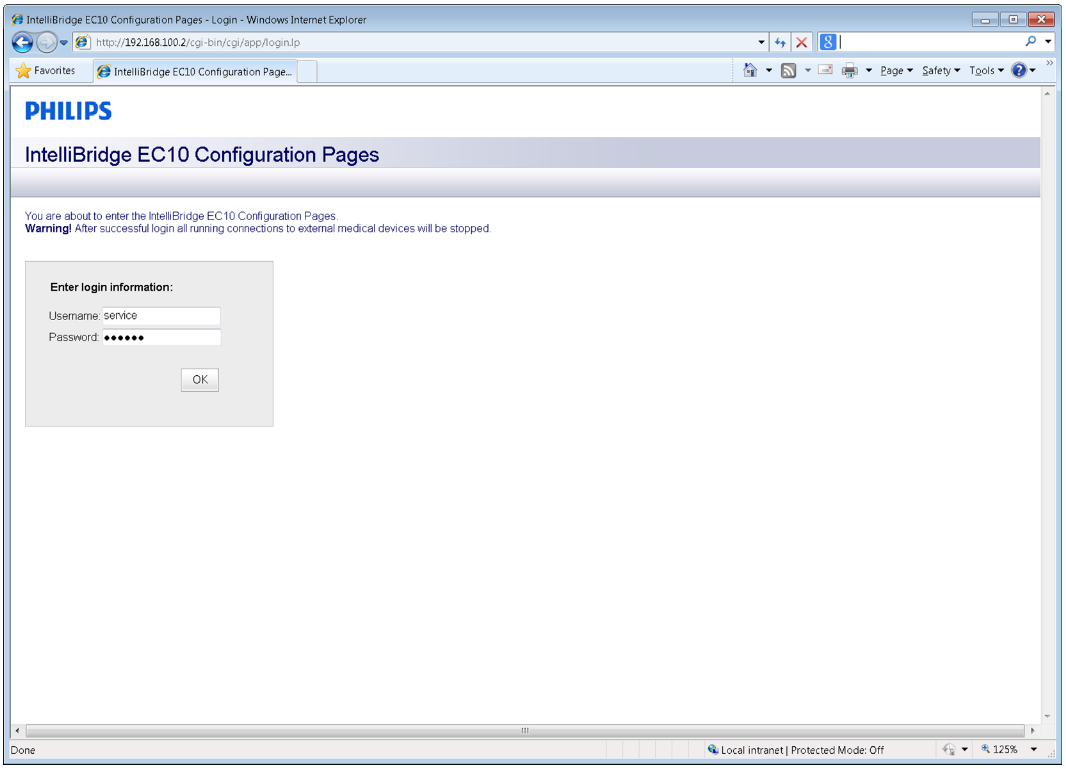
The IntelliBridge EC10 web based service interface allows you to:

- upgrade the EC10 Firmware
- upload or remove device drivers
- generate and upload clone files

- view system information

Accessing the IntelliBridge EC10 Service Interface

1. Connect the Service PC to the IntelliBridge EC10 module or IntelliBridge EC10 interface board using a standard LAN cable.
2. Make sure that the TCP/IP settings of your Local Area Connection Properties on the Service PC are set to "**obtain IP Address automatically**".
3. Open your Internet Browser. Internet Explorer 8 and Firefox 3.5 are supported. Newer versions of these browsers may also function.
4. Enter **192.168.100.2** in the navigation field of the internet browser.
5. The EC10 Configuration screen will open up. Enter the following login information:
   Username: service
   Password: IBEC10


IntelliBridge EC10 Configuration Pages - Login - Windows Internet Explorer
Favorites
IntelliBridge EC10 Configuration Page...
Page
Safety
Tools
PHILIPS
OK
Done
Local intranet | Protected Mode: Off
125%

http://192.168.100.2/cgi-bin/cgi/app/login.lp

IntelliBridge EC10 Configuration Pages

You are about to enter the IntelliBridge EC10 Configuration Pages.
Warning! After successful login all running connections to external medical devices will be stopped.

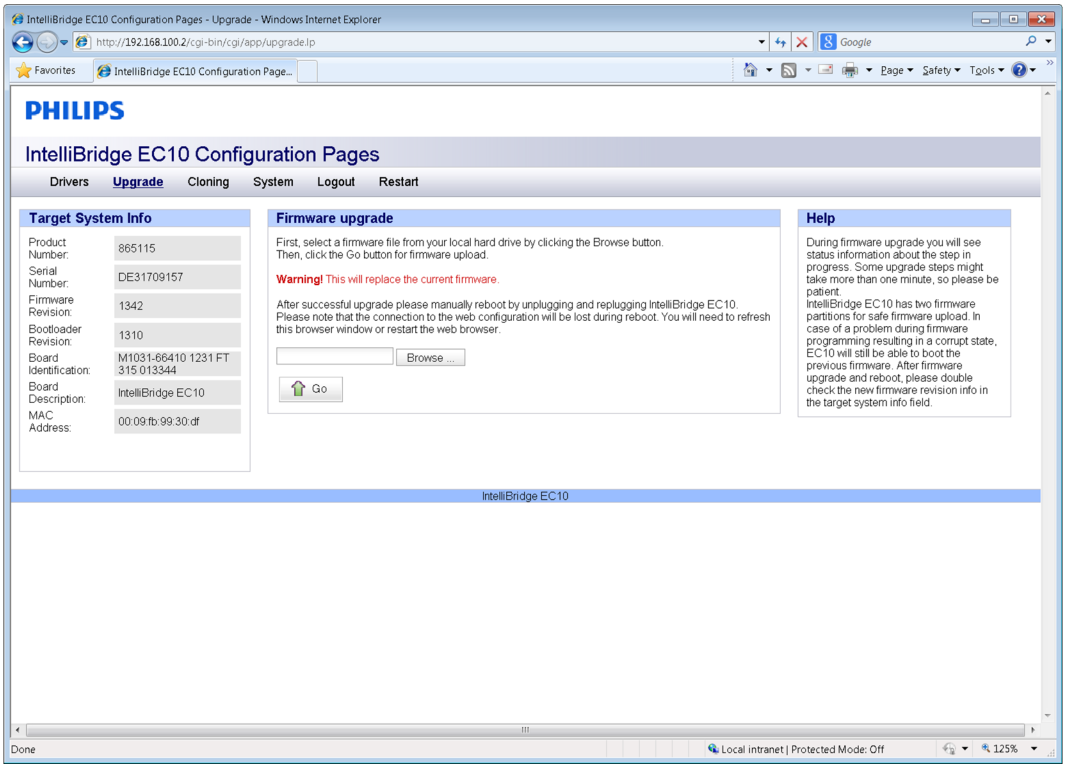
Enter login information:

Username: service
Password: ••••••

Firmware Upgrade

1 In the EC10 Configuration Screen select the tab **Upgrade**.

2 The Firmware upgrade window will open up.


IntelliBridge EC10 Configuration Pages - Upgrade - Windows Internet Explorer
http://192.168.100.2/cgi-bin/cgi/app/upgrade.lp
Favorites
IntelliBridge EC10 Configuration Page...
PHILIPS
IntelliBridge EC10 Configuration Pages
Drivers
Upgrade
Cloning
System
Logout
Restart
Browse ...
Go
IntelliBridge EC10
Done
Local intranet | Protected Mode: Off
125%

Target System Info

Product Number:	865115
Serial Number:	DE31709157
Firmware Revision:	1342
Bootloader Revision:	1310
Board Identification:	M1031-66410 1231 FT 315 013344
Board Description:	IntelliBridge EC10
MAC Address:	00:09:fb:99:30:df

Firmware upgrade

First, select a firmware file from your local hard drive by clicking the Browse button. Then, click the Go button for firmware upload.

Warning! This will replace the current firmware.

After successful upgrade please manually reboot by unplugging and replugging IntelliBridge EC10. Please note that the connection to the web configuration will be lost during reboot. You will need to refresh this browser window or restart the web browser.

Help

During firmware upgrade you will see status information about the step in progress. Some upgrade steps might take more than one minute, so please be patient.
IntelliBridge EC10 has two firmware partitions for safe firmware upload. In case of a problem during firmware programming resulting in a corrupt state, EC10 will still be able to boot the previous firmware. After firmware upgrade and reboot, please double check the new firmware revision info in the target system info field.

3 Click on the **Browse** button and select the correct FW file.

4 Click **Go**.

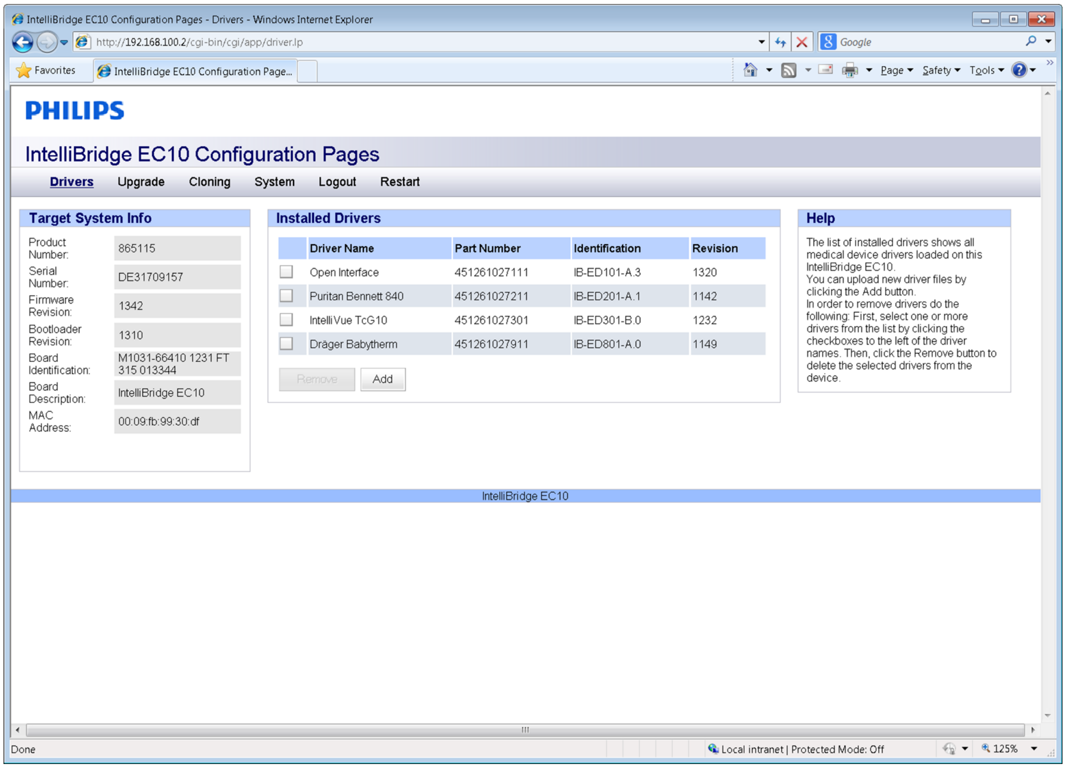
5 After you are finished with the upgrade, make sure to restart the IntelliBridge EC10 device by either clicking on **Restart** (located on the tab bar, if available) or, if you are using an IntelliBridge EC10 module, by unplugging and replugging the module.

Uploading and Removing Device Drivers

1 In the EC10 Configuration Screen, select the **Drivers** Tab.

2 A list of the available drivers on the IntelliBridge EC10 will appear.

3 To upload a new driver, click the **Add** button, then click the **Browse** button and select the driver file. To remove one or more drivers, select the driver(s) from the list of available drivers and click the **Remove** button.


IntelliBridge EC10 Configuration Pages - Drivers - Windows Internet Explorer
http://192.168.100.2/cgi-bin/cgi/app/driver.lp
Google
Favorites
IntelliBridge EC10 Configuration Page...
Page
Safety
Tools
PHILIPS
IntelliBridge EC10 Configuration Pages
Drivers
Upgrade
Cloning
System
Logout
Restart
Remove
Add
IntelliBridge EC10
Done
Local intranet | Protected Mode: Off
125%

Target System Info

Product Number: 865115
Serial Number: DE31709157
Firmware Revision: 1342
Bootloader Revision: 1310
Board Identification: M1031-66410 1231 FT 315 013344
Board Description: IntelliBridge EC10
MAC Address: 00:09:fb:99:30:df

Installed Drivers

	Driver Name	Part Number	Identification	Revision
☐	Open Interface	451261027111	IB-ED101-A.3	1320
☐	Puritan Bennett 840	451261027211	IB-ED201-A.1	1142
☐	IntelliVue TcG10	451261027301	IB-ED301-B.0	1232
☐	Dräger Babytherm	451261027911	IB-ED801-A.0	1149

Help

The list of installed drivers shows all medical device drivers loaded on this IntelliBridge EC10.
You can upload new driver files by clicking the Add button.
In order to remove drivers do the following: First, select one or more drivers from the list by clicking the checkboxes to the left of the driver names. Then, click the Remove button to delete the selected drivers from the device.

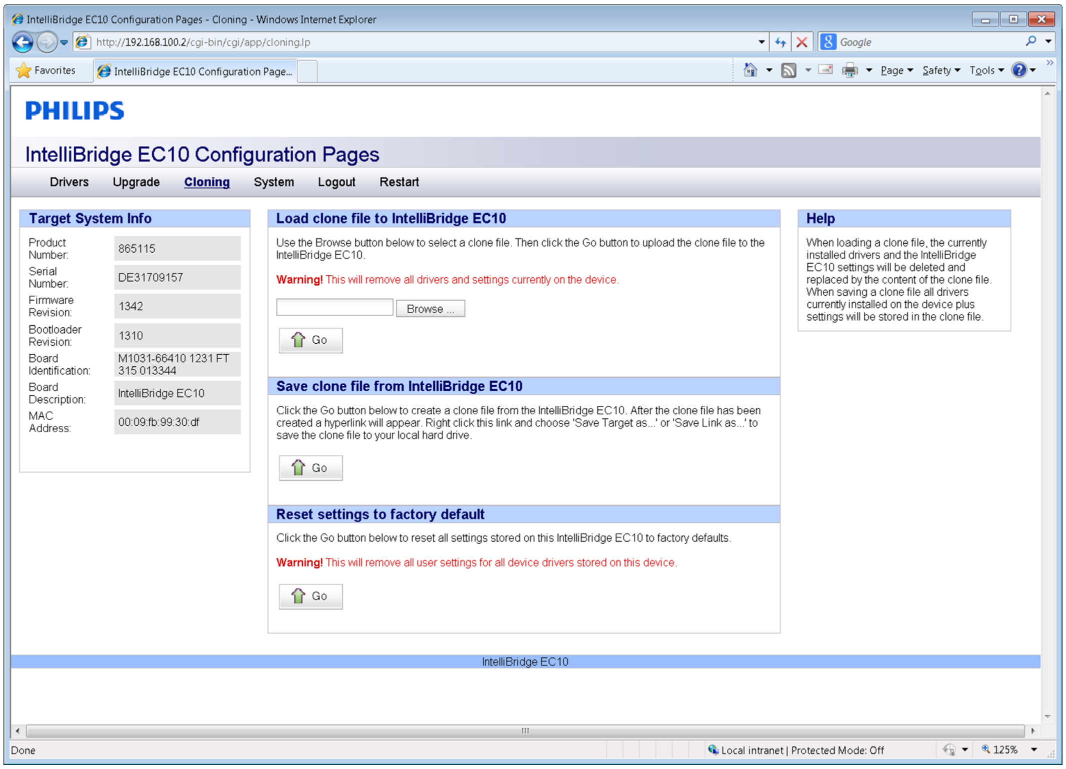
4 When you are finished with the configuration, make sure to click **Logout** on the tab bar.

Generating and Uploading Clone Files

1 In the EC10 Configuration Screen, select the **Cloning** tab.

2 To generate a clone file, click the **Go** button in the *Save clone file from IntelliBridge EC10* window. A hyperlink will appear. Right click this link and select **"Save Target as..."** to save it to the desired location.

3 To upload a clone file click the **Browse** button in the *Load Clone File to IntelliBridge EC10* window and select the clone file. Then click **Go**.


IntelliBridge EC10 Configuration Pages - Cloning - Windows Internet Explorer
http://192.168.100.2/cgi-bin/cgi/app/cloning.lp
Google
Favorites
IntelliBridge EC10 Configuration Page...
Page
Safety
Tools
PHILIPS
Drivers
Upgrade
Cloning
System
Logout
Restart
Browse ...
Go
Go
Go
IntelliBridge EC10
Done
Local intranet | Protected Mode: Off
125%

IntelliBridge EC10 Configuration Pages

Target System Info

Product Number:	865115
Serial Number:	DE31709157
Firmware Revision:	1342
Bootloader Revision:	1310
Board Identification:	M1031-66410 1231 FT 315 013344
Board Description:	IntelliBridge EC10
MAC Address:	00:09:fb:99:30:df

Load clone file to IntelliBridge EC10

Use the Browse button below to select a clone file. Then click the Go button to upload the clone file to the IntelliBridge EC10.

Warning! This will remove all drivers and settings currently on the device.

Save clone file from IntelliBridge EC10

Click the Go button below to create a clone file from the IntelliBridge EC10. After the clone file has been created a hyperlink will appear. Right click this link and choose 'Save Target as...' or 'Save Link as...' to save the clone file to your local hard drive.

Reset settings to factory default

Click the Go button below to reset all settings stored on this IntelliBridge EC10 to factory defaults.

Warning! This will remove all user settings for all device drivers stored on this device.

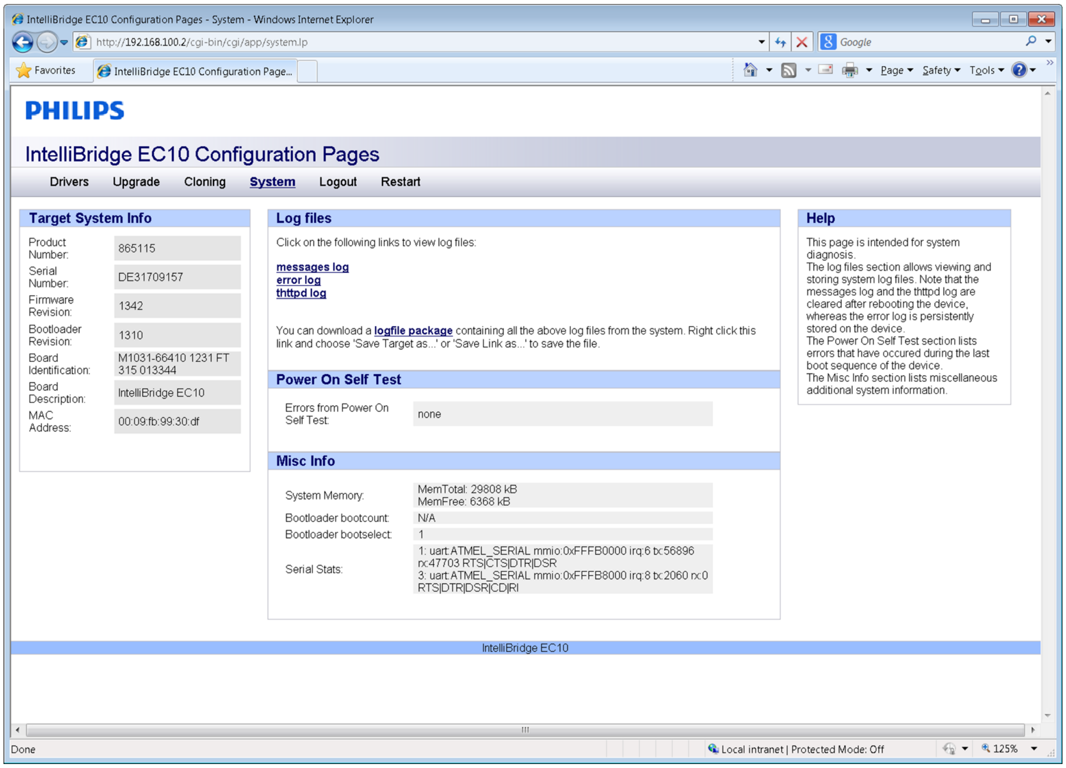
Help

When loading a clone file, the currently installed drivers and the IntelliBridge EC10 settings will be deleted and replaced by the content of the clone file. When saving a clone file all drivers currently installed on the device plus settings will be stored in the clone file.

4 When you are finished with the configuration, make sure to click **Logout** on the tab bar.

Viewing System Information

1 In the EC10 Configuration Screen, select the **System** Tab. This screen allows you to view Log files and other system information.


IntelliBridge EC10 Configuration Pages - System - Windows Internet Explorer
http://192.168.100.2/cgi-bin/cgi/app/system.lp
Google
Favorites
IntelliBridge EC10 Configuration Page...
Page
Safety
Tools
PHILIPS
Done
Local intranet | Protected Mode: Off
125%

IntelliBridge EC10 Configuration Pages

Drivers Upgrade Cloning **System** Logout Restart

Target System Info

Product Number:	865115
Serial Number:	DE31709157
Firmware Revision:	1342
Bootloader Revision:	1310
Board Identification:	M1031-66410 1231 FT 315 013344
Board Description:	IntelliBridge EC10
MAC Address:	00:09:fb:99:30:df

Log files

Click on the following links to view log files:

messages log
error log
thttpd log

You can download a logfile package containing all the above log files from the system. Right click this link and choose 'Save Target as...' or 'Save Link as...' to save the file.

Power On Self Test

Errors from Power On Self Test:	none

Misc Info

System Memory:	MemTotal: 29808 kB MemFree: 6368 kB
Bootloader bootcount:	N/A
Bootloader bootselect:	1
Serial Stats:	1: uart:ATMEL_SERIAL mmio:0xFFFB0000 irq:6 tx:56896 rx:47703 RTS|CTS|DTR|DSR 3: uart:ATMEL_SERIAL mmio:0xFFFB8000 irq:8 tx:2060 rx:0 RTS|DTR|DSR|CD|RI

Help

This page is intended for system diagnosis.
The log files section allows viewing and storing system log files. Note that the messages log and the thttpd log are cleared after rebooting the device, whereas the error log is persistently stored on the device.
The Power On Self Test section lists errors that have occured during the last boot sequence of the device.
The Misc Info section lists miscellaneous additional system information.

IntelliBridge EC10

2 When you are finished with the configuration, make sure to click **Logout** on the tab bar.

Handing Over the Monitor

If you are handing over the monitor to the end-users directly after configuration, make sure that it is in Monitoring mode.

Ensure that the users have access to the following materials:

- Training Program in the Philips Learning Center (www.theonlinelearningcenter.com) - for self-training on the monitor before use
- Instructions for Use (delivered with the monitor) - for more detailed questions during use.

WARNING

All users must complete the training program and read the Instructions for Use before working with the monitor.

These training materials (in combination with this service guide) can also be used to train service personnel on how to use and service monitor.

Please refer to the Testing and Maintenance section of this service guide to determine the respective safety and performance tests to be performed before handing over the monitor to the customer.

8

Site Preparation

Introduction

This section describes the procedures you should follow to plan and prepare a site for an IntelliVue monitor installation. It describes:

- Site planning.
- Roles and responsibilities for local and Philips personnel.
- Remote installation planning.

Site Planning

The careful planning of the site for the IntelliVue monitor is essential for its safe and efficient operation. *A consulting schedule should be established between the Customer and Philips Sales and Support Representatives, to ensure that all preparations are completed when the system is delivered.*

The site planning phases prior to equipment installation are:

Location: Planning the location of the various system components.

Environment: Confirming and correcting, as necessary, the environment of the proposed installation site(s).

System Capabilities: Explaining the possibilities for system expansion.

Mounting: Referencing the mounting hardware information website for the listing of suitable mounting hardware recommended for use with the various system components, and all details on the available mounts and accessories.

Cabling: Identifying the requirements for the cabling, conduiting and faceplates for connecting the various system components.

Roles & Responsibilities

This section describes the procedures necessary to prepare a site for a system installation. The procedures are grouped into two parts: procedures that local staff or contractors are responsible for, and procedures that Philips personnel are responsible for.

Site Preparation Responsibilities

Local Staff

- Ensure that all safety, environmental and power requirements are met.

- Provide power outlets.
- Prepare mounts.
- Pull cables, install conduit, install wallboxes.
- Terminate network cables if a Philips Clinical Network is in use.
- It may be necessary to certify the network cable plant, see Philips Clinical Network Installation Manual for details.

Philips Personnel

- Provide the customer with the safety, environmental and power requirements.
- Assemble mounts.
- Prepare monitor remote cabling.

Procedures for Local Staff

The following tasks must be completed **before** the procedures for Philips personnel may be started.

- Providing Power Outlets

  One power outlet for each display and for any peripheral device (for example, a printer or slave display) is required by the system. Provide a power outlet in the vicinity (1 m or 3 ft) of each component that requires power.

WARNING

Only the power cables provided with the system may be used. For reasons of safety, power (mains) extension cables or adapters shall not be used.

- Preparing Mounts

  Where ceiling, wall, or shelf mounts are required for mounting the equipment, the customer is responsible for the following:

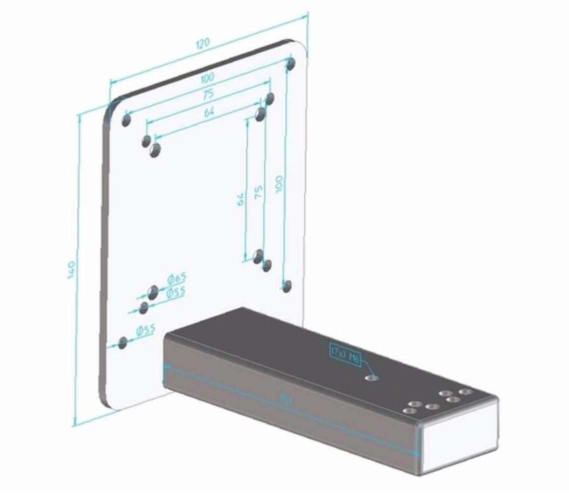
  - Providing and installing all hardware which is required to install the mounting hardware supplied by Philips as detailed in the installation notes.
  - Making sure that all ceilings, walls, and mounting rails that supports mounting hardware are suitable for their proposed load.

WARNING

It is the customer's responsibility to have the attachment of the mounting hardware to the ceiling, wall, or mounting rail and the construction of the ceiling, wall, or mounting rail evaluated for structural integrity and compliance with all local, state and any other required codes by a registered, professional, structural and/or mechanical engineer.

Although considerable effort has been made to ensure the safety of the ceiling mount installation and or mounting guidelines, it is to be understood that the installation itself is beyond the control of Philips Medical Systems. Accordingly, Philips Medical Systems will not be responsible for the failure of any such installation.

The following figures show the dimensions required for the M1180A #C53 wall and the table mounting bracket which ships with the monitor.



Wall Mounting Bracket Dimensions

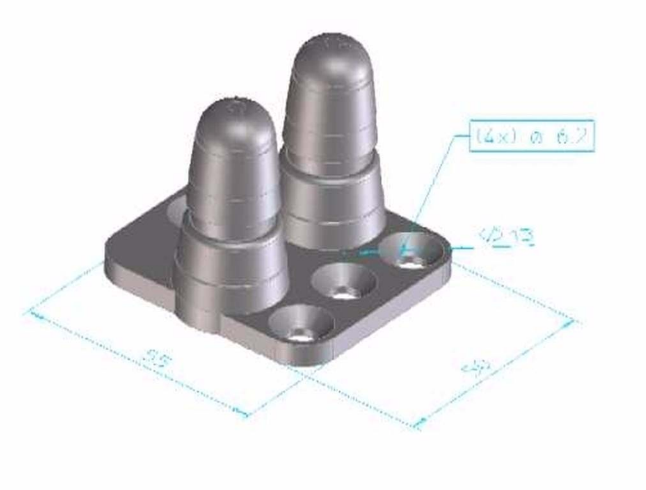


Table Mounting Bracket Dimensions

- Providing Conduit

  Where a remote installation is required, for example the installation of a remote display, the customer is responsible for the following hardware installations:

  - Providing conduit and/or trunking of a sufficient cross-sectional area for the planned cables and possible future expansion (for additional components or systems). See for cable specifications for remote installations.
  - Providing and/or installing suitable wall boxes to accommodate the faceplates.

- Pulling Cables

WARNING

NEVER run power cables through the same conduit or trunking used for system cables.

- Installing Wall Boxes

It is the customer's responsibility to provide and install wallboxes to house faceplates. The customer must notify the Philips installation coordinator of which size is to be used.

Procedures for Philips Personnel

Before you begin the procedures in the installation sections, ensure that the customer has completed all necessary preparations outlined in the previous section, "Procedures for Local Staff."

Monitor MX400/450/500/550 Site Requirements

Space Requirements

The situating of the monitor should be planned such that the nursing staff are able to monitor the patient with relative ease, with all patient connectors and controls readily available and the displays clearly visible. The location should also allow access to service personnel without excessive disruption and should have sufficient clearance all round to allow air circulation.

Maximum dimensions and weight:

Monitor Model	Size (W x H x D)	Weight
MX400	274mm x 288mm x 178mm	5kg (±5%)
MX450	327mm x 288mm x 182mm	5.6kg (±5%)
MX500	327mm x 288mm x 182mm	5.7kg (±5%)
MX550	404mm x 308mm x 184mm	7kg (±5%)

Environmental Requirements

The environment where the MX400/450/500/550 monitor will be used should be reasonably free from vibration, dust and corrosive or explosive gases. The ambient operating and storage conditions for the MX400/450/500/550 monitor must be observed. If these conditions are not met, the accuracy of the system will be affected and damage can occur.

Temperature

Operating: 0 to 40ºC (32 to 104ºF), 0 to 35°C (32 to 95°F) when charging battery or M3002A is mounted on the back of the monitor or with IntelliVue Instrument Telemetry Adapter

Storage: -20 to 60ºC (-4 to 140ºF)

Humidity

Operating: 15% to 95% Relative Humidity (RH) (non-condensing)

Storage: 5% to 95% Relative Humidity (RH)

Altitude

Operating: -500m to 3000m (10000 ft.)

Storage: -500m to 4600m (15000 ft.)

Electrical and Safety Requirements (Customer or Philips)

Safety Requirements

If the monitor is to be used in internal examinations on the heart or brain ensure that the monitor is connected to an equipotential grounding system.

Grounding

The monitor **MUST** be grounded during operation (Class I equipment according to IEC 60601-1). If a three-wire receptacle is not available then the hospital electrician must be consulted to ensure that proper grounding is available on installation. **NEVER** attempt to use a three-wire to two-wire adapter with the monitor.

WARNING

Each component must be individually grounded for safety and interference suppression purposes.

Electrical Requirements

Line Voltage Connection

The MX400/450/500/550 monitor uses < 70 W average.

Line Voltage

The MX400/450/500/550 monitor may be operated on ac line voltage ranges of 100 to 240V, 50/60 Hz.

Remote Device Site Requirements

The system can be installed with one or more combinations of the following remote devices.

Multi-Measurement Module

Remote Display

Remote Control

Where more than one site is used for locating equipment (a remote installation), the following sections should be considered for EACH device:

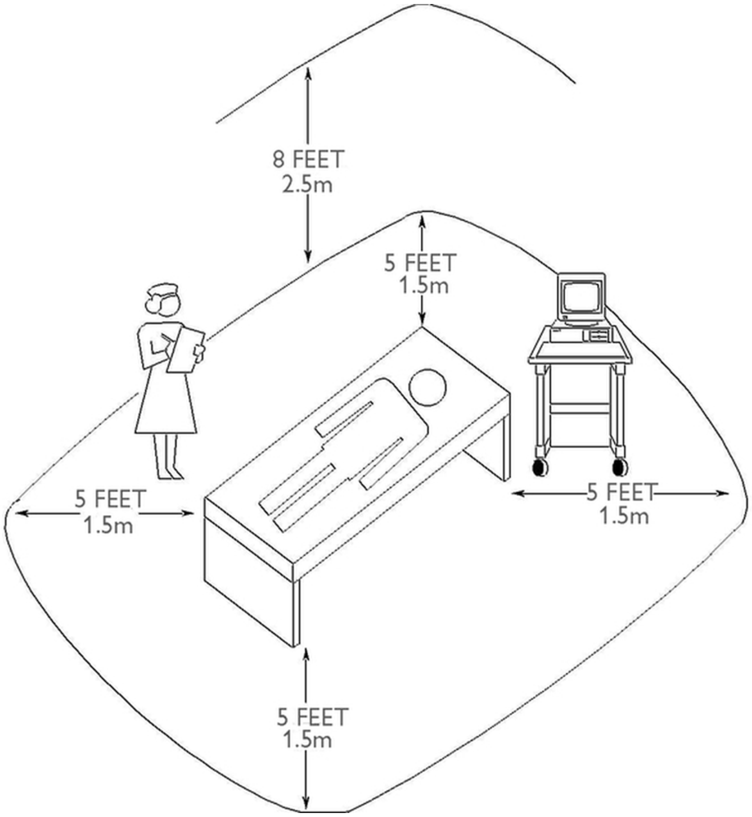
- Space Requirements
- Environmental Requirements
- Mounting
- Electrical and Safety Requirements
- Cabling Options and Conduit Size Requirements

Connecting Non-Medical Devices

The standards IEC/EN-60601-1-1 and IEC/EN 60601-1+A1 Ed.3 clause 16 apply to any combination of medical and non-medical electrical devices, where at least one is a medical electrical device. Therefore IEC/EN-60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16 must still be met after all devices are connected.

WARNING

Do not use a device in the patient vicinity if it does not comply with IEC/EN 60601-1 or IEC 60601-1 edition 3 clause 16. The whole installation, including devices outside of the patient vicinity, must comply with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16. Any non-medical device placed and operated in the patient's vicinity must be powered via a separating transformer (compliant with IEC/EN 60601-1-1 or IEC/EN 60601-1+A1 Ed.3 clause 16) that ensures mechanical fixing of the power cords and covering of any unused power outlets.



Equipment Location in the Patient Vicinity

NOTE

The site planning requirements, with the exception of the cabling, must be provided by the device manufacturer, if the remote device is not purchased from Philips.

Multi-Measurement Module (MMS) M3001A, IntelliVue X2 M3002A or Remote Control 865244

Space Requirements Multi-Measurement Module M3001A

Size (W x D x H)

188.0mm x 96.5 mm x 51.5 mm

(7.40” x 3.80” x 2.03”)

Weight

650g (1.4 lb)

Space Requirements IntelliVue X2 M3002A

Size (W x D x H)

188.0mm x 99 mm x 86 mm

(7.4” x 3.9” x 3.4”)

Weight

1.5 kg (3.3 lb)

Space Requirements Remote Control 865244

Size (W x H x D)

53 mm x 165 mm x 23 mm

(2.1" x 6.5" x 0.9")

Weight

<250 g (0.55 lb)

Environmental Requirements Multi-Measurement Module M3001A

Temperature

Operating: 0 to 45°C (32 to 113°F)

Storage: -40 to 70°C (-40 to 158°F)

Humidity

Operating: 95% relative humidity (RH) max. @ 40°C (104°F)

Storage: 90% relative humidity (RH) max. @ 65°C (150°F)

Altitude

Operating: -500m to 4600m (-1600 to 15000 ft.)

Storage: -500m to 15300m (-1600 to 50000 ft.)

Environmental Requirements IntelliVue X2 M3002A

Temperature

Operating: 0 to 40ºC (32 to 100ºF)
0 to 35°C (32 to 95°F) (while charging batteries or when equipped with IIT or IntelliVue 802.11 Bedside Adapter)

Storage: -20 to 60ºC (-4 to 140ºF)

Humidity

Operating: 15 to 95% relative humidity (RH) max. @ 40ºC (104ºF)

Storage: 5 to 95% relative humidity (RH) max. @ 65ºC (150ºF)

Altitude

Operating: -500m to 3000m (-1600 to 10000 ft.)

Storage: -500m to 4600m (-1600 to 15000 ft.)

Environmental Requirements Remote Control 865244

Temperature

Operating: 0 to 40ºC (32 to 100ºF)

Storage: -20 to 60ºC (-4 to 140ºF)

Humidity

Operating: 15% to 95% relative humidity (RH) (non-condensing)

Storage: 5% to 90% relative humidity (RH)

Altitude

Operating: -500m to 3000m (-1600 to 10000 ft.)

Storage: -500m to 4600m (-1600 to 15000 ft.)

Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the MMS.

Table 9 M3001A and M3002A Cables

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
Both ends are terminated with MSL conntectors					
M3081-61626	453563474781	CBL MSL 0.75m	$72mm^2$	40 mm	40 mm x 17 mm
M3081-61601	453563402721	CBL MSL 1m	$72mm^2$	40 mm	40 mm x 17 mm
M3081-61602	453563377851	CBL MSL 2m	$72mm^2$	40 mm	40 mm x 17 mm
M3081-61603	453563402731	CBL MSL 4m	$72mm^2$	40 mm	40 mm x 17 mm

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
M3081-61627	453563484501	CBL MSL 10m	$72mm^2$	40 mm	40 mm x 17 mm
M3081-61628	453563484511	CBL MSL 15m	$72mm^2$	40 mm	40 mm x 17 mm
M3081-61629	453563484521	CBL MSL 25m	$72mm^2$	40 mm	40 mm x 17 mm
Both ends are unterminated, use faceplates					
M3081-61615	453563484481	CBL MSL Instal.15m unterminated	$72mm^2$	40 mm	40 mm x 17 mm
M3081-61625	453563484491	CBL MSL Instal.25m unterminated	$72mm^2$	40 mm	40 mm x 17 mm
Faceplates					
M3081-68707	453563484531	CBL MSLFace Plate pair of boxes NON US	$72mm^2$	40 mm	40 mm x 17 mm
M3081-68708	453563484541	CBL MSL Face Plate pair of boxes US	$72mm^2$	40 mm	40 mm x 17 mm
Insertion Tool					
M3086-43801	453563484771	MSL Insertion Tool for unterminated CBL	$72mm^2$	40 mm	40 mm x 17 mm

Mounting

Table 10 M3001A Multi-Measurement Module (MMS) and M3002A IntelliVue X2 Mounts

Product Option Number	Part Number 12NC Part No.	Description
M3080A #A01	n/a	Wall Mounting Plate

Remote Displays (865299)

Space Requirements

Size (W x H x D)

429mm x 359mm x 61mm (16.89” x 14.13” x 2.4”)

Weight

6.1 kg (13.45 lbs.)

Environmental Requirements

Temperature

Operating: 0 to 40°C (32 to 104°F)

Storage: -20 to 60°C (-4 to 140°F)

Humidity

Operating: 30 to 70% RH (Non-condensing)

Storage: 10 to 90% RH (Non-condensing)

Altitude

Operating: Up to 4000m (13123.36 ft.)

Storage: Up to 12000m (39370,08 ft.)

Electrical and Safety Requirements

Voltage ranges:

100V to 240V

Voltage selection:

Wide range input, no voltage selection required

Power consumption: ~48W

Cabling Options and Conduit Size Requirements

The following table describes the cabling options for the M8031A/B 15”, the M8033A/B/C 17” and the 865299 19" TFT Medical Grade Touch Displays.

Table 11 Digital Video cables

Part number	12NC	Description
M8071-61001	453563484551	IV CBL 1.5m Cable Kit
M8071-61002	453563484561	IV CBL 3m Cable Kit
M8071-61003	453563484571	IV CBL 10m Cable Kit.

Touch Cable

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
M8081-61010	451261006551	IV CBL Touch, 1.5m	$30mm^2$	25 mm	35 x 16 mm
M8081-61011	451261006561	IV CBL Touch, 3m	$30mm^2$	25 mm	35 x 16 mm
M8081-61012	451261006571	IV CBL Touch, 10m	$30mm^2$	25 mm	35 x 16 mm
M8081-61013	451261006581	IV CBL Touch, 15m	$30mm^2$	25 mm	35 x 16 mm

Part number	12NC	Description	Conduit sizes	Bend Radius	Connector Size (L x W)
M8081-61014	451261006591	IV CBL Touch, 25m	30mm^2	25 mm	35 x 16 mm

Input Devices

Part number	12NC	Description
453564115901	453564115901	KBD KEYBOARD FRENCH Trackball USB
453564115911	453564115911	KBD KEYBOARD ITALIAN Trackball USB
453564115921	453564115921	KBD KEYBOARD GERMAN Trackball USB
453564115931	453564115931	KBD KEYBOARD DANISH Trackball USB
453564115941	453564115941	KBD KEYBOARD SWEDISH Trackball USB
453564115951	453564115951	KBD KEYBOARD ENGLISCH Trackball USB
453564115961	453564115961	KBD KEYBOARD FRENCH Standard USB
453564115971	453564115971	KBD KEYBOARD ITALIAN Standard USB
453564115981	453564115981	KBD KEYBOARD GERMAN Standard USB
453564115991	453564115991	KBD KEYBOARD DANISH Standard USB
453564116001	453564116001	KBD KEYBOARD SWEDISCH Standard USB
453564116011	453564116011	KBD KEYBOARD ENGLISH Standard USB
453564119161	453564119161	KBD KEYBOARD SPANISH Trackball USB
453564119171	453564119171	KBD KEYBOARD SPANISH Standard USB
453564119241	453564119241	KBD Spillcover Trackball US
453564119251	453564119251	KBD Spillcover Trackball EUROPE
453564119261	453564119261	KBD Spillcover Standard US
453564119271	453564119271	KBD Spillcover Standard EUROPE
M4046-60103	451261000651	IV-MP70 PCACY Wired Track Ball USB/PS2
M4046-60104	451261000661	IV-MP70 PCACY Optical Mouse USB PS/2
M4046-60105	451261000671	IV-MP70 PCACY WIRELESS TRACKBALL USB/PS2
M4046-60106	451261000681	IV-MP70 PCACY WIRED TRACKBALL USB/PS2
453564119281	453564119281	PCACY Wireless Off Table Mouse EU
453564203401	453564203401	PCACY Wireless Off Table Mouse US
453564203391	453564203391	PCACY Wireless Off Table Mouse UK

IntelliBridge

Cabling Options

Part number	12NC	Description	Conduit Sizes	Max. Bend Angle	Connector Size (L x W)
M8081-61001	453563484591	IV CBL 1.5m LAN/ RS232 straight	30 mm^2	25 mm	15 x 15 mm
M8081-61002	453563484601	IV CBL 3m LAN/RS232 straight	30 mm^2	25 mm	15 x 15 mm
M8081-61003	453563484611	IV CBL 10m LAN/ RS232 straight	30 mm^2	25 mm	15 x 15 mm

Local Printer

See printer documentation

RS232/MIB/LAN Interface

Table 12 MIB Cable and Serial Cable

Part number	12NC	Description	Conduit Sizes	Max. Bend Angle	Connector Size (L x W)
M8081-61001	453563484591	IV CBL 1.5m LAN/ RS232 straight	30 mm^2	25 mm	15 x 15 mm
M8081-61002	453563484601	IV CBL 3m LAN/RS232 straight	30 mm^2	25 mm	15 x 15 mm
M8081-61003	453563484611	IV CBL 10m LAN/ RS232 straight	30 mm^2	25 mm	15 x 15 mm
M8081-61004	453563484621	IV CBL 15m LAN/ RS232 straight	30 mm^2	25 mm	15 x 15 mm
M8081-61005	453563484631	IV CBL 25m LAN/ RS232 straight	30 mm^2	25 mm	15 x 15 mm

Cable and Adapter Set

Nurse Call Paging Cable

Part number	12NC	Description	Conduit Sizes	Bend Radius	Connector Size
453564214531	453564214531	CBL Nurse paging cable 3m	0.125 mm^2	12 mm	9 x 12 mm One end terminated with 6P6C connector. one end without connector.
453564220531	453564220531	CBL Nurse paging cable 10m	0.125 mm^2	12 mm	9 x 12 mm One end terminated with 6P6C connector. one end without connector.
M8087-61001	453563484741	IV CBL 10m flex nursepaging MDR&open con	40 mm^2	30 mm	35 x 16 mm One end terminated with straight MDR connector, one end without connector

ECG Out Interface

Table 13 ECG Out Cable

Part number	12NC	Description	Conduit Sizes	Bend Radius	Diameter	Comments
8120-1022	453563198151	CBL ECG Out 3m Phone plug terminated	40 mm^2	30 mm	13 mm	3m cable (Both ends are terminated with .25” phone plugs
M1181-61625	453563255091	CMS CBL ECG OUT CABLE KIT 25m				cable kit consisting of: 25 m raw cable, 2 x 1/4” socket, 1 x 1/4” plug
M1783A	989803105251	Sync Cable 12-pin 2.5M. (8ft.)				one end is terminated with ECG 12 pin and one end is terminated with phone plug
M5526A	989803129001	24' Sync Cable				one end is terminated with ECG 12 pin and one end is terminated with phone plug

9

Gas Analyzers

For details on the M1013A IntelliVue G1 and the M1019A IntelliVue G5, please refer to the respective Service Guides on the Gas Analyzers' documentation CD.

For details on configuring the RS232/MIB port for the gas analyzers, see “Connection of Devices via the RS232/5V Interface or MIB/RS232 I/O Board” on page 261 in the Installation Instructions chapter

10

Specifications

For detailed device specifications please refer to the Instructions for Use. This section provides information on the essential performance and the MDD classification of the monitor.

Essential Performance Characteristics

This chapter defines the Essential Performance for IntelliVue patient monitors, in combination with Multi-Measurement-Modules (MMSs), MMS Extensions, measurement (plug-in) modules and IntelliVue Cableless measurement devices.

Under normal and single fault conditions either at least the performance / functionality listed in the table below is provided or failure to provide this performance / functionality is readily identifiable by the user (e.g. technical alarm, no waves and/or numeric values, complete failure of the monitor, readily identifiable distorted signals, etc.).

Parameter	Essential Performance
General	No interruption or cessation of current operating mode (e.g. no reboot, display ok). No spontaneous operation of controls (e.g. no activation of touch screen without user interaction).
BIS	Measurement of bispectral index (BIS).
C.O./C.C.O	Measurement of blood temperature within the specified accuracy/ error limits.
	Alarming on blood temperature limit violations.
ECG	Measurement of heart rate within ±10% or ±5 bpm, whichever is greater.
	Alarming on Asystole, or heart rate limit violation within specified delay time.
	Detection of VFIB and alarming on it.
	ECG-Out Signal delay ≤ 35 msec.
EEG	Measurement of spectral edge frequency, mean dominant frequency, peak power frequency, total power, as well as the percentage of power in bands alpha, beta, theta and delta.

Parameter	**Essential Performance**
Invasive Pressure	Measurement of systolic, diastolic and mean blood pressure within ±4% or ±4 mmHg, whichever is greater, and pulse rate within ±10% or ±5 bpm, whichever is greater.
	Alarming on systolic, diastolic and mean blood pressure and pulse rate limit violations.
NBP	Measurement of systolic, diastolic and mean blood pressure and pulse rate within specified accuracy / error limits.
	Automatic cycling.
	Alarming on systolic, diastolic and mean blood pressure limit violations.
NMT	Measurement of Train-Of-Four, Post-Tetanic-Count, Double Burst and Single-Twitch stimulation responses.
	Alarming on TOF Count limit violation.
Respiration	Measurement of respiration rate within specified accuracy/ error limits.
	Alarming on apnea and on respiration rate limit violation.
Respiratory Gases (CO$_2$, O$_2$, N$_2$O, Anesthetic Agents)	Measurement of respiratory gases within the following measurement accuracy ranges: **Halogenated agent**: ± (0,2 % absolute + 15 % of reading) **CO2**: ± (0,43 % absolute + 8 % of reading) **Nitrous oxide**: ± (2,0 % absolute + 8 % of reading) **O2**: ± (2,5 % absolute + 2,5 % of reading)
	Measurement of airway respiration rate within specified accuracy/ error limits.
	Alarming on apnea, airway respiration rate and respiratory gas limit violation.
Spirometry	Measurement of spirometry values within specified accuracy/ error limits.
	Alarming on apnea and PEEP, PIP, MV and respiration rate limit violation.

Parameter	**Essential Performance**
SpO_2	Measurement of oxygen saturation within $4\%_{RMS}$ over the range from 70 to 100% and pulse rate within $10\%_{RMS}$ or 5 bpm_{RMS}, whichever is greater.
	Alarming on oxygen saturation and pulse rate limit violation.
Intravascular Oxygen Saturation	Measurement of intravascular oxygen saturation within specified accuracy/ error limits.
	Alarming on intravascular oxygen saturation limit violation.
$tcpO_2/tcCO_2$	Measurement of partial pressure O_2 within ±6 mmHg over the range from 40 to 100 mmHg and partial pressure CO_2 within ±6 mmHg over the range from 30 to 60 mmHg.
	Alarming on transcutaneous partial pressure O_2 and CO_2 limit violation.
Temperature	Measurement of temperature within specified accuracy/ error limits.
	Alarming on temperature limit violation.
Predictive Temperature	Measurement of temperature within specified laboratory accuracy/ error limits.
	Alarming on temperature limit violation
Tympanic Temperature	Measurement of temperature within specified laboratory accuracy/ error limits.
	Alarming on temperature limit violation.

The table above also represents the minimum performance when operating under non-transient electromagnetic phenomena according to IEC 60601-1-2:

- Radiated electromagnetic fields
- Conducted disturbances induced by RF fields
- Conducted disturbances induced by magnetic fields
- Voltage dips/ voltage variations

The following table identifies minimum performance for transient electromagnetic phenomena according to IEC 60601-1-2:

- Electrostatic Discharge (ESD)
- Electrical Fast Transients / Bursts
- Surges
- Voltage interruptions

- Electrosurgery (ESU)

Parameter	Essential Performance
All	After electrostatic discharge, fast transients / bursts, surges and electro surgery interference the equipment returns to previous operation mode within 30 seconds (tcpO2/tcpCO2: 60 seconds) without operator intervention and without loss of any stored data.
	After voltage interruptions the equipment returns to previous operating mode without operator intervention and without loss of any stored data.

MDD Classification

According to the Council Directive 93/42/EEC (Medical Devices Directive) the device classification is IIb, according to Rule 10.

Safety and Regulatory Information

For details about safety and regulatory information, refer to the Instructions for Use.

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IntelliVue MX400-550 Product Structure

Please refer to the following documents on InCenter or LMS for product structure information:

Document	12NC
MX Portable Options US	452299103561
MX Portable Options RoW (Non-US)	452299103551
MX Portable Upgrades US	452299103541
MS Portable Upgrades RoW (Non-US)	452299103531

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